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AND

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THE EMERYVILLE SHELLMOUND.

BY

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CONTENTS.

Introduction.

California has but few characteristic archaeological remains such as are found in the mounds of the Mississippi valley or the ancient pueblos and cliff-dweller ruins of the South. In the shell-mounds along this section of the Pacific coast it possesses, however, valuable relics of very ancient date. These are almost the only witnesses of a primitive stage of culture which once obtained among the early inhabitants of this region.

Some years ago Professor Merriam recognized the necessity of exploring these ancient mounds and represented the facts to the University of California. Mrs. Phoebe A. Hearst generously made the undertaking possible by providing ample financial support for the exploration work.

One of the largest and best preserved shell-mounds was selected

as the object of the present investigation, which was entrusted to Professor Merriam and the writer. The mound selected is situated on the eastern side of the Bay of San Francisco at Shellmound Station near Emeryville, and is commonly known as the Emeryville mound. At present it forms a conspicuous feature of the recreation grounds known as Shellmound Park (pl. 1).

The water of the bay rises to within 130 feet of the base of the mound (pl. 3) during high tide. The beach is then only one foot above the water level, while the ground in the immediate vicinity of the mound is from two to three feet higher. This ground is quite level and forms a part of an extensive alluvial flat. A small creek, having its source about three miles away, in the hills back of Berkeley, passes the mound on its south side, at a distance of two hundred feet, and empties into the bay. In summer the creek runs dry, but its bed furnishes a channel for subterranean water. Another, lower mound, containing graves, lay on the site of the Emeryville race-track near by, but it has been leveled down during the construction of the track. The shellmound which was the object of the excavation has the form of a truncated cone, with a diameter of 270 feet at its base and 145 feet at the top, and rising 27 feet above the plain. On the north side its foot extends 100 feet farther over the flat, a few feet higher than the level of the ground about it.

Twenty-five or thirty years ago the shore line of the bay lay fifty feet farther out; a pile set at that time is still to be seen at that distance from the beach. It is above the water during high tide and marks the coast line on this side of which floodland was sold by the State. The top of the mound was not at that time crowned by the wooden pavilion which is there at the present time. It was still ungraded, having its natural conical form, and was covered with a wild growth of bushes and brambles. The creek, as yet unregulated, followed its own course and overflowed the land, causing it to become marshy. In the seventies and eighties of the last century, railroad tracks were laid along the eastern side of the mound, and took in a section of its eastern foot. At that time a number of graves and Indian artifacts were discovered. Few of these, however, found their way into the collections of the University, then but recently founded.

of Northern California, those surrounding swamps and rivers along the Tulare and Kern lakes in southern California,[3] and on the shore near Santa Cruz. Others are found in the regions of San Luis Obispo,[4] of Santa Barbara,[5] and the islands opposite that place.

Early References to Shellmounds of Middle California.

All the publications treating of the shellmounds of central and northern California, which from the nature of their contents are different from those of the coast and the islands of southern California, may be condensed into the following bibliography:

The Smithsonian Reports of 1869 mention a collection of artifacts from the shellmounds of Alameda county presented to the Institute by Dr. Yates.[6] J. W. Foster, in 1874, speaks of a newspaper notice concerning a shellmound in the region of San Pablo.[7] James Deans follows in 1876 with a short notice (together with drawings of some artifacts) concerning a mound between Visitacion Valley and Point Bruno on the western shore of the Bay.[8] A short notice by H. H. Bancroft, accompanied by views of four objects, points to the great historical value of the shellmounds.

[3] Warren K. Moorehead, Prehistoric Implements, 1900, p. 258.

[4] Paul Schumacher, Smithson. Reports, 1874, p. 335 ff.

[5] Schumacher, Bulletin of the U. S. Geol. and Geogr. Survey of the Territories (F. V. Hayden), 1877, III, p. 73 ff.; F. W. Putnam, Reports upon Archaeological and Ethnological Collections from vicinity of Santa Barbara, Cal., etc.; Report upon U. S. Geogr. Surveys west of the 100th Meridian (G. M. Wheeler), 1879, VII, Archaeology. From more northern sections of the Pacific Coast may be mentioned specifically the shellmounds of Oregon (P. Schumacher, Bulletin, *l. c.*), of Vancouver, and of the mainland of British Columbia opposite (H. H. Bancroft, Native Races of the Pacific States, 1886, IV, p. 739), also those upon the Aleutian Islands, explored exhaustively by W. H. Dall (in U. S. Geogr. and Geol. Survey of the Rocky Mountain Region, J. W. Powell, Contributions to the North American Ethnology, 1877, I, p. 41 ff.). Together with those of California these shellmounds are an important counterpart to those found along the Atlantic coast, found from Nova Scotia to the Gulf of Mexico, as well as in the river valleys of nearly all the southern states (Charles C. Abbott, Primitive Industry, 1881, p. 439, Short, The North Americans of Antiquity, 1882, p. 108), and almost all of which have been carefully studied in some of their aspects, although not yet conclusively.

[6] Smithson. Reports, 1869, p. 36.

[7] Prehistoric races of the United States of America, 1874, p. 162.

[8] Journal of the Anthropological Inst. of Great Britain and Ireland, 1876, V, p. 489. The majority of these shellmounds have been graded down.

The Marquis de Nadaillac in his well known work mentions the shellmounds in the vicinity of San Francisco.[9] Moorehead in his work gives a few remarks on excavations in shellmounds of central California.

The Nature of the Excavations.

The work of exploration was commenced by Professor Merriam and the writer in February, 1902, toward the end of the rainy season, and was finished early in May. Captain Siebe, the proprietor of Shellmound Park, gave all possible assistance in the investigation. Owing to the presence of the circle of trees around the truncated top of the mound it was necessary to confine the excavations to a lateral section and a tunnel extending from it toward the center of the mound. However desirable a more extended section through the hill might have been, the results obtained in these partial excavations are as a whole similar to those which would have been obtained by a cut through the entire mound.

The western slope of the mound, facing the bay, was selected as the starting point for the operations. The entire work of excavation may in a chronological order be divided into the following four stages.

A. The first lateral cutting in the mound. This was made in the western foot of the mound, seven feet and a half above the level of the bay and at a distance of fifty feet from the plateau. The trench was two feet deep, eighteen feet long and six feet wide, its floor sloped towards the center of the mound.

B. Tunnel construction. The tunnel formed the underground continuation of the trench; it was the means of reaching the interior of the mound and down to its original base. Hence the floor of the tunnel was made to slope steeply inward. The tunnel was extended from the end of the trench *A* for forty-two feet into the interior of the mound, and at its terminal point it sank to two feet below the level of the bay. It was five feet wide and six and a half feet high. Several distinct strata were cut through by the tunnel section. Eleven feet of the length of the tunnel extended under the plateau of the mound. This was still

[9] Prehistoric America, ed. by W. H. Dall, 1885, p. 50.

sixty feet from the vertical center of the hill (pl. 4), but the observations made in this interior part of the mound were of a relatively greater value than those of the outer zone. Many difficulties were met during the construction of the tunnel, among which the porosity of the soil was one of the worst. The tunnel was therefore timbered and its sides sheathed. Another difficulty was the ground water, of which there was often a very strong flow when digging in the lower part of the tunnel. According to the advance of the season, it was encountered at different depths, and it grew less with the approach of summer. A small hand pump was used to exhaust this water, but it barely answered the purpose, and it was often with great difficulty that the inrushing water could be mastered.

C. The upper vertical cut of the entire mound. In order to obtain a view of all the strata contained in the mound this section was undertaken. The lowest parts of the mound having been thoroughly explored by the construction of the tunnel, it was now sufficient to make the upper sectional cut only as deep as the roof of the tunnel, while its terminal point was fixed by the circle of trees on the summit of the mound. Its greatest length from the mouth of the tunnel was twenty-six feet. The sides of the cut were sloped in order to prevent the fall of loose soil and to avoid the cost of timbering. The length of this section at its lower end, near *b* (pl. 4), was reduced from 26 feet to 19 feet, and the width to 10 feet along the entire foot of the trench from *a*[9a] to *b*. In pl. 5 there is shown the first cut into the mound, before it had been made wider by five feet throughout its length. In making this cut the earth was removed stratum by stratum. For want of other marks of division, the dividing lines of the various strata (I to VII) were chosen arbitrarily from the several visible lines of structure, and they are marked in the diagram, pl. 4, by asterisks. In order to obtain a uniform classification of the contents of the mound it was thought necessary to introduce the same lines of division in the sectional diagram of the tunnel; objects found there had been marked previously by the distance of their position from the mouth of the tunnel and their relative height.

[9a] *a* seems to have been situated at the intersection of the dotted lines separating divisions *A*, *B*, *C*, pl. 4, fig. 2.—Editor.

These strata in conformity with the numbering of the upper ones were marked as numbers VII to X.

D. A series of pits was dug from the foot of the tunnel out to the bay shore. The pits were made in order to ascertain the general outline of the base of the mound under the cuts already made, as well as under the unexcavated portion of the mound farther out toward its margin. The pits are marked as *h* in the interior of the mound, and as *i, k, l, m,* toward its periphery. The two pits *n* and *o*[9b] are situated on the outside of the superficial foot of the mound, at a distance of 35 feet and 67 feet from the nearest pit, *m*. It was here seen that the terminal point of the foot of the mound lay between the pits *n* and *o,* the pit near *n* showing only the debris of the shellmound, while that near *o* revealed nothing of it. These two pits were connected by a trench, which gave an exceedingly interesting section of the margin of the mound.

The Base of the Mound.

The mound consists mainly of a mass of broken or entire shells, ashes, bits of charcoal, and some artifacts. This mass extends far above the surface of the surrounding land and ends two and a half feet below the level of the ground water and two feet below the general tide level of the bay, and rests immediately upon a sharply defined yellowish alluvial clay stratum. There is no indication of a rocky elevation which might have served as an inducement for the original settlement, and would have helped to raise the mound to its present height. Some of the charcoal and small boulders brought here by man rest upon the clay soil. A slight discoloration of the upper line of the clay stratum may have been caused by a transitory plant growth during some early period, while there is no indication of a crust of good soil which would be a sign of a longer period of vegetable growth upon it.

The base of the mound is horizontal according to all indications gained between pits *h* and *m*. A slight variation of the level of the ground near *h* of but a few inches does not materially change this level. Between *m* and *n,* however, the original

[9b] Pit *o* referred to in the text seems to be represented in pl. 4, fig. 1, by the west end of the cut extending from *n* to *l*.—Editor.

soil lies one foot and seven inches lower for a distance of thirty-five feet, and from *n* to *o* the level drops a foot lower. The mound was originally founded upon a site rising two feet above the adjacent ground on its western side. A gravel stratum of 8 inches in thickness near *o*, and of 4 inches near *p*, but disappearing towards *n*, covered the clay which originally sloped to the west. This gravel stratum was examined by Professor Lawson and considered to be probably a fresh-water deposit and not a deposit formed in the bay, as the gravel is more or less angular instead of much water-worn. The mound terminates near *p*, 177 feet from its center, where it runs to a point between layers of clay, which are above and below it (pl. 4, fig. 1). It rises again toward the outside for the last 17 feet measured from the depression *n*, the difference being one and one-quarter feet, thus varying from the rest of the base which inclines to the west. A stratum of ferruginous clay, the same as that underlying the base of the mound, is here inserted between the gravel stratum and the characteristic mixture of which the mound is composed, and covers it up even with the present surface of the soil. This raises the actual height of the shellmound from 27 feet to 32 feet and the actual diameter to at least 310 feet instead of 270 feet. The volume of the mound, measured as a truncated cone, may be estimated as being 55,000 cubic yards, or about 39,000 cubic meters.[10]

[10] The shellmounds in the vicinity of the bay differ considerably in shape and size. The majority appear as extended plateaus 10 to 12 feet in height, others appear as slight undulations of the ground about five feet in height. The truncated conical form is found more rarely; the mound at Ellis Landing near Point Richmond approaches it somewhat in its proportions. Many of these mounds cover acres of ground, *e.g.*, the mounds of Alameda, of Sausalito, of Sierra Point, of West Berkeley (in its older form, now much changed). In tropical regions many shellmounds are said to reach a height of 100 feet or more; this is known with certainty of some in Brazil (cf. Nadaillac, *l. c.*, p. 54), and also of two near the dried-up mouth of the Ica river in Peru. Shellmounds as a rule are much smaller. On the Atlantic coast near Smyrna a shellmound is said to be thirty feet high (Short, *l. c.*, p. 107), but the majority of these mounds are less than four feet high (cf. Wyman, Amer. Naturalist, 1868, I, p. 56 ff., and Abbott, *l. c.*, p. 440), while many of them extend over areas of more than two or three acres. A shellmound near the mouth of the Altamaha river in Florida is estimated as having a size of over 80,000 cubic yards (Smithson. Rep., 1866, p. 358). The shellmounds of Denmark are only from 3 feet to 10 feet high, although more than a thousand feet long (Ranke, Der Mensch, II, p. 552). Southern California shellmounds generally are from 4 feet to 5 feet high (P. Schumacher, Bull., *l. c.*, p. 38; and Smithson. Rep., 1874 ,p. 337, etc.). The same is the case with those mounds on the Aleutian Islands explored by W. J. Dall. In Oregon there are some of at least 8 feet in height (cf. Schumacher, *l. c.*, p. 29).

shores of San Francisco Bay.[13] The ground under the mound having a slope of two feet, it may be assumed that the original foundation of the base was at least one foot above tide level. Accordingly the coast must have sunk three feet since the formation of this mound.[14] This sinkage was leveled up again to its former height by later alluvial deposits, in consequence of which the originally dry base of the mound is now situated two feet below the level of the bay, while the surrounding flats are three feet above it.

It is to be noted that the younger alluvial deposit, near *o* (pl. 4) has a thickness of six feet.

Samples of soil taken from various parts of the clay stratum underlying the base of the mound were subjected by Professor W. A. Setchell to microscopical examinations, but no Diatoms were found in any of them. Hence those strata were probably formed of alluvial deposits of the creek, as Professor Lawson had at first suggested, and not of deposits of the bay. This finding is entirely in accordance with the origin of the gravel stratum as above stated.

The slope of the mound was an obstacle to the course of the creek when it became swollen. In the natural course of things it deposited a bar near the foot of the mound, which, when the edge of the latter gradually extended, grew out over this new obstacle. The creek in the same manner continued to heap up alluvial deposits against the latter. The horizontal growth of the mound and the vertical growth of the surrounding land took place simultaneously. This was the cause of the brim-like upward curve of the edge of the mound as seen in the cross section (pl. 4). While the mound increased about seventeen feet in its periphery, the vertical alluvial accumulation was about one and one-half feet. Hence the base of the mound peripherally increased one foot while the ground grew one inch, showing that the alluvial growth of the soil was much slower than the peripheral growth of the

[13] Near the mouth of the valley of San Rafael a small hill rises from the bay, the isolation of which from the mainland may be explained in this way.

[14] Between the shellmounds of Emeryville and West Berkeley the shore for a long stretch forms a steep bank up to twelve feet high, and broken down by the water of the bay. Possibly the coast at this point formed a promontory on the two sides of which these shellmounds were originally founded, as in sheltered bays, similar to other mounds of this region.

mound. About 310 cubic yards or 240 cubic meters produce a growth of one foot in a mound 9 feet high and about 300 feet in diameter at the base. If the peripheral growth of the mound had continued with the growth of the soil, the foot of the mound would have spread out so that the outer edge would rest in the highest or surface layer of the present alluvium. The wedge-like margin situated between alluvial strata is, however, proof that its peripheral growth ceased a long time before the termination of the alluvial accumulation in this region, as a result of which the alluvium has spread itself over the foot of the mound. The alluvial deposit above the wedged-in margin of the mound (at *p*) being 3 feet 8 inches in thickness, and the alluvium deposited underneath it from the beginning of the formation of the mound measuring only 1½ feet, and assuming the increase to have been absolutely uniform, a period two and a half times as long has passed since the ceasing of its peripheral growth, as had been necessary for a peripheral growth of 17 feet on each side. The cessation of this peripheral growth of the mound, however, is not identical with the cessation of its growth altogether. It took place apparently when the mound began to grow more acutely conical in shape, whereby it increased to twice its former volume. Assuming that the mound was abandoned 100 years before the end of the alluvial growth of the land in the vicinity, then according to formula

$$100 \times \tfrac{3}{8} f = 2\tfrac{1}{2} \times \tfrac{1}{8} f$$

it might be concluded that the mound was probably 600 years old before it was abandoned.[15] Several numerical values upon which the formula is based are unfortunately so uncertain that the result may not be considered as more than suggestive of the possible age.

The sinking of the coast and the alluvial increase of the ground since the first settlement of the mussel-eaters would in themselves give an adequate measure for an estimate of the age of the mound if the measures upon which both depend were not also unknown; according to Professor Lawson, this probably occu-

[15] In that case the sinkage would have amounted to about 6 inches, the alluvial increase to about 9 to 10 inches in a century.

pied centuries at least.[16] At any rate, such observations as have been made furnish good reasons for believing that the founding of a settlement and the beginning of the heaping up of the mound occurred at a remote date.

THE INTERNAL STRUCTURE OF THE MOUND.

The principal constituents of the mound are the shells. These have nearly all crumbled into small fragments and are slightly mixed with soil, which when damp gives the entire mass the appearance of pure soil. When this is flooded with water the washing away of the sand produces no noticeable change in its volume. This mass has mingled with it bits of charcoal, bones of animals, ashes or cinders, and stones averaging about the size of one's fist and blackened by fire.[17] Marks of stratification may be traced through almost the entire mound. Plate 5, representing a photographic view of the excavation, shows the stratification planes in the walls quite distinctly. The strata consist of compact masses of more or less fragmentary shells, or of beds of ashes or cinders. In many cases the latter seem to extend through the entire mound. They are sometimes not thicker than a sheet of heavy paper, but show the general direction of the bedding planes, and form a clear contrast with the homogeneous, dark mass of broken shells.[18] These planes become somewhat less distinct in the deeper strata.[19] As in other shellmounds,[20] there were observed certain rounded masses of shells intersecting the lines of stratification. These are

[16] The rapidity of the sinkage of alluvial coasts varies greatly owing to local conditions. For the Atlantic Coast the rate of sinkage is 2 feet per century (cf. Abbott, *l. c.*, p. 449). Applying this same rate to the eastern coast of the Bay, we would arrive at the absurd result that the shellmound of Emeryville had begun to form in 1750, while that date was presumably the end of its occupied state.

[17] The descriptions of nearly all the shellmounds explored in other parts of the world tally exactly with this one; cf. Ranke, *l. c.*, II, p. 532, for the Danish Kjökkenmöddinger; Schumacher, on the general similarity of shellmounds of the Pacific Coast with the mounds in Denmark, Smithson. Rep., 1874, p. 358, etc.

[18] Although no shellmound is free from stratification marks, owing to the gradual growth of the strata, Brinton maintains that this is the case with shellmounds on the Atlantic Coast (Smithson. Rep., 1866, p. 356).

[19] Compare the interesting observations of Wyman (Amer. Naturalist, I, p. 571) concerning shellmounds of New England, that there the shells of the lowest stratum were softer and more crumbled than those of the upper strata.

[20] Cf. Wyman, *l. c.*, p. 363, on a shellmound in the vicinity of Portland, Me.

mark the sites of former sweat-houses or council-halls; these curves, such as that from *f* to *g*, may have a similar origin.[23]

The manner in which the mound was occupied for habitation varied in the upper strata. With the growth of the mound the diameter of the plateau decreased instead of expanding. From line *b* upward the strata incline obliquely toward the sides. This change in the manner of forming the mound signifies a change in the character of its occupants. It would be interesting to determine, if possible, the exact line where these two types of growth have met. It might have been about 12 feet above the base, so that the mound grew in the shape of a shallow plateau as far as the middle of stratum V in pl. 4, and that it changed after this period to its conical form.

Constituents of the Mound.

Shells.—The shell layers of the mound are composed principally of the following species:

Oysters, *Ostrea lurida.*
Mussel shells, *Mytilus edulis* and *Mytilus californianus.*
Clams, *Macoma edulis* and *Macoma nasuta.*

Many other kinds of shells, including the following species, were found scattered through the mound:

Purpura crispata and *canaliculata.*
Cerithidea californica.
Helix, two species indet.
Cardium corbis.
Standella, sp.
Tapes staminea.

Of these last species, the cockle, *Cardium corbis,* and the clam, *Tapes staminea,* occur quite frequently.[24] All of these were used as food by the occupants of the mound. The various species of *Helix* were probably also used, as they were in more recent times eaten by the California Indians.[25] It may be, however, that this species lived on the mound.

[23] Somewhat smaller but quite similar hollows are still preserved upon the surface of the shellmound of Ellis Landing, and are doubtless sites of houses of that nature.

[24] Eight-tenths of all the shells found in the Oregon shellmounds belong to the species of *Mytilus californianus, Tapes staminea, Cardium nuttalii,* and *Purpura lactuca* (Schumacher, Smithson. Rep., 1874, p. 335).

[25] As by the Minooks and the Nishinams (Powers, *l. c.*, pp. 348 and 430); and certainly the custom was a very general one.

Bones.—Bones of vertebrates are also found in most of the shellmounds. These together with the shells represent the debris of their kitchens. No other shellmound has been seen where so large a quantity of bones was observed as in that at Emeryville. Bones of land and sea mammals, of birds, and of fishes were found in abundance throughout the mound, and fairly evenly distributed in the strata. This fact is the more remarkable since the shellmound at West Berkeley, scarcely two miles distant, does not yield nearly such quantities of bone as this one. The occupants of the mound at Emeryville at all periods were huntsmen to a great degree, besides being fishermen; those of the mound at West Berkeley seem to have depended largely upon fishing; hence the stone sinkers were far more numerous in that mound than at Emeryville.

So far the fauna of only the lowest strata up to 3 feet above the base have been studied. The following species obtained in this horizon were determined by Dr. W. J. Sinclair.

Deer, *Cervus* sp.
Elk, *Cervus canadensis.*
Sea-otter, *Enhydrus lutris.*
Beaver, *Castor canadensis.*[27]
Squirrel, *Spermophilus* sp.
Rabbit, *Lepus* sp.
Gopher, *Thomomys talpoides.*
Raccoon, *Procyon lotor.*
Wild cat, *Lynx* sp.
Wolf, *Canis* sp.
Bear, *Ursus* sp.
Dog, *Canis familiaris.*[28] (?)
Seal, *Phoca* sp.
Sea-lion.
Whale.
Porpoise?
Canvasback Duck, *Aythya vallisneria.*
Goose?
Cormorant, *Phlaeocorax* sp.
Turtle.
Skates, Thornbacks, and other fish.

[27] Extinct in California, and in fact south of Washington; J. Wyman found the remains of elk, wild turkey, and large auk in the shellmounds of New England. The elk, though still in existence, is no longer to be found east of the Allegheny Mountains; the wild turkey is still in existence, but is not to be found in New England, while the auk lives only in the Arctic regions, or at least not farther south than the northern part of Newfoundland (Amer. Naturalist, I, p. 572).

[28] Also found in the shellmounds of New England.

were only those of very resistant material, such as stone or shell. All other kinds, such as textiles of plant fibre, baskets, and implements of wood, which doubtless have also existed, had disappeared. The more resistant artifacts were distributed throughout all layers of the mound.[33]

About 200 cubic meters of earth were removed and sifted during the excavations, and yielded 600 artifacts of various kinds, averaging three specimens to one cubic meter. The volume of the whole mound we computed to be about 39,000 cubic meters, and it may be assumed that by excavating the entire mound the yield would be about 100,000 specimens, which indicates that many generations must have lived here to deposit such a large number of objects of imperishable material alone.[34]

The same computation was applied to each separate layer in the mound, and it was shown that the yield differed according to the section and the stratum explored. The open cut *A* yielded one specimen to .75 cb. m., and the tunnel *B* and the pits *h* to *m*, six per cb. m. Section *C* yielded three artifacts to one cb. m. This computation shows that sections nearer the center of the mound yielded the greater number, those toward the edge a smaller number. It also appears that the lower strata contained a larger percentage of artifacts than the upper ones. If, however, the number of flaked chert fragments were subtracted from the yield of the lower strata, their percentage would be much the same as that of the higher layers. The following are the contents of the various strata:

Stratum I had 20 artifacts per 15½ cb. m. = 1.3 per cb. m.
Stratum II, 30 cb. m—133 objects = 4.4 per cb. m.

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[33] It is alleged that there are shellmounds in the East which contain no implements at all, and have been used for the gathering of mussels only, and not as dwelling places (Abbott, p. 447, accord. to Charles A. Woodley). Equally uncertain seems to be the distinction made by Schumacher between shellmounds yielding few artifacts and those containing a larger number, as representing a place for temporary or permanent habitation. Similarly dubious is that classification which considers the piling up of shells in various separate heaps as proof of permanent abode and that of single mounds for the use only as temporary stopping places (Smithson. Rep., 1874, pp. 337 to 338).

[34] W. J. Dall (contrib. *l. c.*, I, p. 47) states that during his excavations of the shellmounds of the Aleutian Islands he found on the average one object in one-half ton of earth. This would be 2.63 objects to one cb. m. The yield of the Emeryville shellmound is three objects to one cb. m.

Stratum III, 20⅜ cb. m.—27 objects = 1.16 per cb. m.
Stratum IV, 11¾ cb. m.—41 objects = 3.5 per cb. m.
Stratum V, 9⅝ cb. m.—34 objects = 3.5 per cb. m.
Stratum VI, 4⅛ cb. m.—9 objects = 2.1 per cb. m.
Stratum VII, 2⅘ cb. m.—10 objects = 3.5 per cb. m.

The specimens contained in the graves in strata VI and VII were not counted in with the rest. This comparison shows mainly that stratum II is the richest in implements. The connection of this fact with the preponderance of ashes will be pointed out later.

BURIALS.

Shellmounds originate on the accumulated refuse deposited by people who have lived in the place when the heap has formed, and the mounds may therefore be regarded as sites for dwelling places, or abodes for the living, and not as mounds set aside as burial grounds by people living elsewhere in the vicinity. Whenever these mounds were used for burials it was not done in spite of their being dwelling places, but rather because they were such.[35]

Many tribes of a low grade of civilization follow the custom of burying their dead underneath their feet in the ground upon which they live, to protect the graves of their dead against being disturbed and also to enjoy the protection of the spirits of the departed against their enemies. Wherever graves are found in shellmounds, in all parts of the world, their presence is generally to be explained in this way.[36]

Ten graves containing skeletons were found during the excavations. They were found only in the middle layers of the mound in a zone extending from stratum VI to stratum VIII. The two lowest layers and the five upper ones contained no evidence of interment, indicating that the custom of burial underneath the

[35] See P. Schumacher, Bull. *l. c.*, p. 38, for burials in the mounds on the Island of San Miguel.

[36] Virchow found them in the Spanish shellmounds (Ranke, *l. c.*, II, p. 533), while in those of Denmark they are absent. Schumacher (Smiths. Rep., 1874, p. 337) states that he observed shellmounds in Southern California which had been temporary abodes only and were devoid of graves; while D. G. Brinton asserts that in Florida graves occurred in natural shellmounds, while artificial shellmounds were free of them (*l. c.*, 1866, p. 357). Such general statements cannot be accepted unless they are supported by observations over larger fields than these.

dwelling places was observed in one period only. We have no evidence concerning the location of the burials previous to that period or subsequent to it. A burial site slightly elevated above the plain was unearthed some years ago under a shellmound near the principal mound in Emeryville, but as this probably dated from the same period as the graves in the shellmound no light is thrown upon the question.

In the upper strata of the mound there is, however, furnished evidence of a different manner of disposing of the dead, which was observed during the period of the deposition of strata II, III, and IV. During the period represented by strata VI to VIII the dead were buried in the ground. It has already been shown that stratum II consists mainly of ashes and calcined shells, which cannot be regarded as kitchen-midden deposit or as the remains of fireplaces, the latter forming an inconspicuous part of the stratum. Another characteristic feature of this layer is the high percentage of calcined bone implements found there. Very common among them are awls, of which stratum II contained 44 calcined specimens, or 72 per cent. of the whole number. In the other layers a much smaller number has been found, but the percentage of calcined specimens is high. The supposition that these were accidentally burned cannot be considered an adequate explanation, but the fact that a number of human bones were found at the same place in the strata gives weight to the theory that during the deposition of the upper beds the inhabitants of this region practiced cremation of their dead, a custom common among the California tribes of today. Then as now they were accustomed to burn all personal belongings with the body.[37] This accounts for the large number of calcined bone objects and shells in stratum II. Doubtless a large number of shell-fish were thrown into the fire as food for the departed on their long journey into the next world.

Doubtless the practice of cremation was not confined alone to the period of stratum II. The percentage of calcined awls in other strata than this suggests that the builders during the ac-

[37] H. C. Yarrow, Introduction to the mortuary customs among the North American Indians, 1880, p. 58, points out that this custom was general among those Indians who cremated their dead.

entirely during the time of the earlier plateau-like growth of the mound. This period of burial is very closely followed by that of cremation, the two possibly overlapping.

The preparation of the graves was not elaborate. A simple pit sufficed. It was made large enough to place the body in it with the knees drawn up. The sides of the grave were left bare. If a covering existed originally it must have been of perishable materials, for none have been found in excavation. The bottom of the grave, however, was prepared somewhat like a bed. A layer of charcoal from one-half inch to one inch thick is found at the very bottom, above that another layer of like thickness of iron oxide. Upon this the body was laid on its side. It is evident that the body was buried with its clothing and personal ornaments, in exceptional cases with utensils or implements only. The body was tightly bound at the knees before burial. Owing to climatic conditions, causing excessive moisture in the strata, the greater part of the material buried with the corpse has decayed and disappeared. Five of the ten graves were entirely lacking in implements or other artifacts.

Before burial the body was entirely covered with the red earth mentioned above. This settled down upon the bones after decomposition and is still adhering to them in some cases like a thick crust. The hands were placed on the body in different ways. In several instances the left hand rested upon the knees, while the other was raised to the mouth or to the crown of the head. The corpse is usually laid upon the right side, generally facing northeast. Associated with a number of skeletons were a variety of interesting ornaments, including beads made from shells of *Olivella* and other molluscs and from sections of bird bones strung together. With skeleton No. 4 were associated a large number of perforated mica flakes. The flakes of mica may originally have been fastened to a garment which shrouded the dead, and when this decayed in the earth the flakes remained there about the body. Beads of bird bone were found in the mouth also, but their presence there might be explained by the settling of the skull in the earth. Mica was much used by the Indians for ornamentation. It has been observed in Peru in a number of cases in the vicinity of graves, but circumstances did not show whether

region also the varying positions in which the corpses face is confirmed by Schumacher.[45]

To the layer of charcoal and red iron oxide which generally formed the bed of the dead may be compared the "thick burned brick-like crusts" and the "thin light colored crusts" found by Schumacher in Southern California graves.[46] A large number of lumps of red coloring earth were found throughout the mound, some of these showing marks of scraping or cutting. In Southern California graves we find conditions resembling these almost identically.[47] Up to recent times the California Indians very generally painted their bodies, and there is undoubtedly a religious significance in this practice of daubing the corpses and associated objects with red coloring material, besides depositing them on red earth. The custom of putting red coloring matter on the body of the dead is found with many aboriginal tribes. So the Caribs in Jamaica[48] paint the entire body of the corpse. The Santees of South Carolina[49] painted face, neck, and hands of the corpse. The Dakotas[50] painted the face alone. In a number of Peruvian mummies the faces were painted red. Crania from ancient Peruvian graves that had been disturbed at some early time were also found covered with red paint.

The absence of implements is explained by Schumacher by the analogous custom of the lower Klamath tribes, where the implements are laid upon the grave instead of being buried with the dead.[51] This custom may have prevailed in this shellmound.

It was an unfortunate circumstance that the exploration in Emeryville occurred at a season of the year when the interior of the mound was still very damp from preceding rains. For this reason none of the skulls could be secured intact, and they will need to be carefully prepared before use can be made of them for

[45] F. W. Putnam, Rep. upon U. S. Geogr. Surveys, *l. c.*, p. 30; Schumacher, Smithson. Rep., 1874, p. 341.

[46] Smithson. Rep., 1874, p. 342.

[47] Putnam, *l. c.*, p. 22; Schumacher, Smithson. Reports, 1874, p. 350.

[48] Yarrow, Introduction to the Study of Mortuary Customs among the North American Indians, 1880, p. 54.

[49] Schoolcraft, Archives of Aboriginal Knowledge, 1860, IV, p. 156.

[50] Yarrow, *l. c.*, p. 71.

[51] Bulletin *l. c.*, p. 34.

anthropological study. It may be noted that none of them show striking eccentricities of form.

Following is a detailed statement of the occurrence and the contents of each of the ten burials excavated.

No. 1, pl. IV, fig. 2, was found 9 feet below the present surface; it may be contemporaneous with the graves of stratum VII (as 6 and 9). The skeleton was that of an adult, drawn up in the usual manner. It was laid on its right side and was facing east. The left arm rested upon the knee, the right hand on the crown R of the head, where also was found a cockleshell. The skeleton lay on a bed of red soil; the bones were slightly reddened. No associated objects.

No. 2. Skeleton of an adult, found at a depth of 9 feet in the outer part (A) of the excavation; neither red earth nor associated objects present. The burial dated probably from the same period as the preceding.

No. 3. Grave of a young person, about 15 years of age, in stratum VI. The skeleton was facing northwest. No artifacts or other associated objects.

N. 4. Grave of an adult, in stratum VI. The skeleton lay from east to west upon a double bed of charcoal and red earth. Interspersed in the soil were found a great quantity of flakes of mica 1 to 1¾ inches in diameter, rhomboidal, triangular, and irregular in shape, and each with a hole at one end (see pl. II, fig. 18); also a quantity of beads made of bird bones were found upon the cranium as if they had formed part of a net drawn over it; others lay along the sides of the head and along the temples.

No. 5. Skeleton of an adult lying from east to west and facing north. Stratum VI. The cranium shows a lupus-like mutilation of the nose (fig. 2). No ornaments.

No. 6. Grave of a child a little over a year old, found in the tunnel in stratum VII*a*, at a depth of 17 feet below the surface. It lay from north to south upon a bed of charcoal and red earth. Various ornaments and other articles were taken from this grave, all covered with red earth. A number of shell beads, both flat (cf. pl. 11, figs. 6*a* and 6*b*), and concave forms (pl. 11, figs. 5*a* and 5*b*) lay in rows from the neck down along the body, and were originally necklaces; two bored round pieces and two oblong ones

(pl. 11, figs. 1 and 2) of *Haliotis* shell had completed the necklace. An unusual object (pl. 11, fig. 8) found here was a flat ring three-eighths of an inch wide, three-sixteenths of an inch thick, neatly made of stone, both surfaces being decorated with a number of shell beads, originally 11 to 12 on each side, fastened with asphaltum. This object may have been a pendant, but doubtless it possessed talismanic virtues.

Shell beads like the larger convex ones of *Olivella* sp. have been pictured by Holmes as objects belonging to early and modern Indians of California. Possibly they also resemble the shell coin "Kolkol" of the modern Indians, which is made of *Olivella*

Fig. 2.* Skull showing lupus-like mutilation of the nose. × ½.

biplicata, according to Powers, and was strung in such a manner that the beads faced each other in pairs, but are not much in use in modern times.

A shell ring of similar proportions as above, but differing through its inferior material and the absence of decoration, has also been pictured by Holmes as coming from Illinois, and as being an ear ornament presumably, while the object described above could not have served that purpose.

* Fig. 1 has been omitted owing to double references in the manuscript.—Editor.

The bone implements taken from this grave have the shape of paper cutters; there are five in all, representing two distinct types. Three are made of a hard bone (pl. 8, fig. 4) and are imperfect at their upper ends; the form is that of a horn, the worn edges show their use as tools; the other two objects (pl. 8, fig. 5) are made of a much softer bone; they are unfinished at their lower ends. The two types are distinct, although it is difficult to compare them in their very imperfect condition. The upper end of the implement of the second type shows two hooked projections connected by an outward bending of their rims. They have each a hole on the lower edge of such a size as to admit a finger, to facilitate the handling of the tool. Neither of these types was met in other parts of the mound.

An *Olivella* shell with side perforation similar to that of plate 11, fig. 4, from a grave on Santa Rosa Island has been represented by Holmes.[52] Bone beads similar to that of figs. 16 and 17 on plate 11 were found in nearly all the strata of the mound; two of these are shown in figs. 13 and 14 of the same plate, the former, 1–8702, from stratum IV, the latter, 1–8743, from stratum V. It also has a remnant of a former axle-like connection with another bead as was shown in fig. 15 from stratum V. Bone beads have been widely used as objects of adornment by the California Indians, as is the case with many tribes in other parts of the world.[53] With the Yokuts bird bone pieces of 2½ inches in length at one time represented a value of 12½ cents.

No. 9. A child's grave, in stratum VII*a*, in the tunnel about 18 feet below the surface. The associated objects were convex shell beads (cf. pl. 11, figs. 5*a* and 5*b*) and a cockleshell upon the crown of the head (cf. grave No. 1).

No. 10. Grave of an infant with very delicate bones. It was found in the lowest part of section VIII, 23 feet below the surface.

Age of the Mound.

The shellmounds of the environs of San Francisco Bay are almost the only witnesses of a practically unknown period in the

[52] Art in Shell, pl. XXXII, fig. 2.

[53] W. H. Dall, for instance, found them among other places in shellmounds on the Aleutian Islands (Smithson. Contrib., 1878, No. 318, pl. 10, No. 17261.

into hills which come to form prominent features of the landscape. Though little is definitely known, the beginnings of human social organization evidently reached back into Quaternary time, just as is the case with the beginnings of human ornamentation. There is therefore no good reason why the origin of the shellmounds could not date back to Quaternary time. In this connection mention must be made of the fact that, according to Cook,[55] stone implements of argillite, which would consequently be attributed to the palaeolithic man, were found in a shellmound of New Jersey. The well known shellmounds of Denmark, the so-called "Kjoekkenmoeddings" (*i.e.*, "Kitchen debris"), which first attracted the attention of scientists to the remnants left by prehistoric men, are not so old.[56] Nevertheless, it has been possible to prove by them that Denmark had at the time of their origin a flora considerably different from that of the present, and that the Auerhahn, too, lived there, which does not exist in Denmark to-day. J. Wyman, a very careful explorer of the shellmounds of New England, does not consider the Atlantic shellmounds of this continent as old as those of Denmark.[57] He seems to have taken this view because he met with no authentic proofs of a greater age. These were difficult to obtain. Yet he calls attention to the finding of traces of the auk, the wild turkey, and the elk in those shellmounds, *i.e.*, animals which no longer exist in the region of shellmounds investigated by him. According to him, their disappearance took place in historic times.

In determining the age of the Emeryville mound we note first the fact that no traces of typical Quaternary animals were found in it. It is interesting to find that this mound resembles those just mentioned in regard to the finding of traces of the beaver, an animal no longer met with in this region. It was found in one of the lower strata of the mound. How far it reaches upward cannot as yet be decided, since the large number of bones taken from the upper beds have not all been examined. Since the time that remains of this animal were deposited in the lower strata of

[55] Quoted by Abbott, *l. c.*

[56] Cf. J. Ranke, Der Mensch, II, p. 536. These shellmounds are placed in the earlier stone age of the current geologic periods.

[57] *l. c.*, p. 571.

Besides these, the two lower strata furnished only an oval, flattened pebble, probably used as a hammer, the only one of its kind in the whole mound.

These four stone implements represent the only specimens of the two lowest strata of the mound which are not chipped. A little above these the excellently polished tool 1–8925 (pl. 10, fig. 9) was found (in stratum VIII). This is the only one of such workmanship before the IVth stratum upwards. Therefore it is by no means impossible that rubbed or polished stone implements, excepting mortars and pestles, were unknown at the time of the origin of the lower strata, and that their use was rather limited in the succeeding strata. But the presence of mortar fragments and pestles in the lowest strata points toward a higher development of the human type than is usually expected of men who use flaked tools only.

It will have become evident from the foregoing remarks that the general zoological, geological, and anthropological facts which are available for fixing the age of the mound offer only indefinite evidence; uncertain even for an approximate dating of the time of the mound's beginning. They do not preclude the possibility of an age numbering many centuries; neither do they prove it. Under such circumstances it seems proper to take into account some more general considerations which appear in a study of the shellmounds of the bay as a whole.

We shall probably not make too great a mistake if we estimate the number of the larger shellmounds around the Bay of San Francisco to be over 100. So many and such enormous shellmounds can not possibly have been constructed by human hands unintentionally in any small number of centuries. Furthermore, they form a link of a larger chain of similar mounds which stretch northerly along the coast and inland from Southern California to beyond Vancouver and possibly still farther; *i.e.*, a distance of 18 degrees of latitude. The extension of such a similar manner of life over so great an area speaks of itself for the work of a great number of centuries. Even the complete development of this peculiar mode of existence, as represented in these mounds, must have taken centuries. And this is the more probably true since in those earlier stages of cultural evolution advances in the

kinds of bones lie scattered about. It would be an easy matter to show that the last inhabitants of the hill exhibited the later cultural conditions which prevailed during the time of the Incas in the valleys of Pisco and Ica, about 1460 A.D.

Returning to California, there can be no doubt that the hill-like camp places of the Indians in the interior of the country represented a local variation of the shellmounds along the shore. The form and structure of these camping places resemble the shellmounds of the coast. The material differs in part, since the inhabitants of the inland had fewer shells at their disposal. These camping places were inhabited by the Indians quite recently, or are even now inhabited.[61] The time when the shellmounds of the Bay shore were vacated by their owners was therefore probably not very long ago. With this view coincides the fact that in the upper strata of the shellmound burial is represented by cremation; a form of burial observed up to the most recent times among the Indians of California. The white immigrants settled first on the seacoast, and it is therefore natural that the aborigines retreated earlier from their shellmounds than their brethren in the interior did from their camp places.

Thus, while the history of the shellmounds of this region probably reaches back more than a thousand years into the past, it must have extended almost to the threshold of modern times. The fact that their roots reached far back into the prehistoric period of California does not prevent our seeing the tops developing almost to the present day.

Cultural Stages Represented.

If we attribute to the shellmound an age representing many centuries, cultural differences should be indicated in the successive strata. For it is impossible that the cultural state of one and

[61] The old Indian camping place at Knight's Landing (on the Fair Ranch), at the mouth of a tributary of the Sacramento river, was inhabited, according to authentic information (T. Coleman), as late as 1849 by 150-200 "Digger" Indians. They departed in 1865. The shells, of which only a small number have been found, are of *Mytilus*. A similar mound in Colusa county, 20 miles to the northwest, is still populated by Indians. The Wintun Indians are still accustomed to obtain shells for food by diving into the river. This caused Powers (*l. c.*, p. 233) to surmise that a race somewhat like theirs might have erected these shellmounds.

that most of them practiced cremation, and concerning the Karok, Yurok, and Wintun he relates that they bury their dead, while the Yokuts under certain circumstances make use of both customs. The inhabitants of the upper strata of the mound may undoubtedly be assumed to have followed the customs of the majority of modern Californian tribes in the disposal of their dead. Contrasting with this custom is burial in the ground. In this connection interesting evidence is furnished by the strata of this mound: here at least cremation was preceded by interment. In strata IV to VIII of this mound we find this custom prevailing, and we are forced to assume it to have been practiced by the population living on the mound during the time from the deposition of the lower part of stratum VIII to that of the middle of stratum V. In their manner of burial the knees were drawn up, resting upon the side, resembling on the whole the mode of burial in the shellmounds of Santa Barbara county in California, and in those found in Oregon. Instead of suggesting that the mode of burial is a recent one, the findings in the lower strata of the mound at Emeryville might hint that possibly the shellmounds of Southern California and Oregon are older than is at present believed. The Yokuts likewise bury their dead with drawn-up knees, but whether lying on one side is not mentioned. Also of the Wintun detailed information as regards their mode of burial is missing. But even if a majority of tribes should still practice the form which prevailed in the middle strata of the mound, this would not change the fact that the whole mode of burial at this place designates an earlier ethnical stage. The manner in which the inhabitants of the lower strata of the mound—say from the bottom portions of the VIIIth stratum to the bottom of the Xth—buried their dead is not known, because no graves or other evidences of burial appear in them. It is not impossible that their mode of burial differed again from the two kinds of burial found in the strata lying above.

Another striking difference between the upper and lower layers is found in the characteristic implements of the strata. This difference is best represented by a comparative table. In order to understand this better, we give the relative volume of earth moved for each stratum. In the table the volume of the VIIth

stratum (about 100 cubic feet) has been taken as the unit. Bracketed figures in the different columns denote the number of objects which might have been expected as the proportional content of one of the middle strata. In the last two columns the contents of the IXth stratum have for practical purposes been used as a basis.

Layers	Relative Contents	Rubbed* stone implements	Obsidians	Flaked stone implements excepting obsidian	Knife-like implements	Rough awl-like implements
I	5.5	2[5]	2[2]	—	[6]	—[8]
II	10.6	24[10]	11[5]	6[10]	[13]	—[16]
III	7.3	3[7]	4[4]	4[7]	[9]	—[11]
IV	4.2	4	2	4	[5]	—[6]
V	3.4	4[4]	1[1]	5(2)	[4]	—[5]
VI	1.5	—[1]	—[1]	3	[1]	—[2]
VII	1	—[1]	2[1]	6	[1]	—[1]
VII*	2.2	—[2]	—[-]	9	1[2] } 5	[11]
VIII	7.4	1[7]	1[4]	24 } (28)	1[9]	—[3]
IX	3.3	—[3]	1[2]	62	4[4]	5[5]
X	1.8	—[2]	—[1]	17	—[2]	4[3]

Parentheses in the 4th column denote the number of chipped stones which may actually be assumed as tools.

It is evident that the character of the objects in the upper strata is entirely different from that of the implements which are found in the lower beds. Well polished stone implements and obsidians diminish the nearer we come to the bottom. The sporadic occurrence of a well polished stone implement in the 8th stratum of the first column has an entirely abnormal aspect, in view of the otherwise complete absence of such objects from the VIth stratum downward. The abnormal increase of objects of the 1st and 2nd kinds in the IInd stratum is doubtless due to the custom of throwing their possessions into the fire during the cremation of the dead. Still, the IInd stratum yielded a sufficient number of fragments of similar objects which were evidently lost in other ways. So few are furnished by the contents of the lower strata that their limited use is apparently indicated. In fact, even the Vth stratum shares this poverty, for its four polished implements are only represented by fragments of metate-like stones and a tablet of slate, polished on one side. In the lower strata flaked stones (of local materials), bone splinters of an awl-

* Except mortars and pestles.

like shape, and knife-like tools of bone predominate. Among the flaked stones, real implements are very numerous; they are missing in the upper strata. Their technique is primitive. On one side they are flat and are worked on the other side only. This working, too, is crude, and the finishing primitive. The turtle-back form is present. Different kinds of scraper-like tools of primitive form, and of drill-like sharpened stone fragments, must have been more common implements in the hands of the inhabitants of this stage than among the dwellers on the upper strata, where these tools are lacking.

A well formed implement of flaked stone, worked on both sides, was found low down in stratum VIII (a spear-like blade, pl. 10, fig. 14). Strata IX and X offer nothing similar. The leaf-like blade from stratum VIII (pl. 6, fig. 20), where a crude workmanship is paired with an attempt at more regular sharpening of the edges, does not favor the view that the inhabitants of the mound had been well versed from the beginning in the production of chipped implements.

Very remarkable is the occurrence together of crude splinters of bone, which show from long use their real value as tools, and the neat, almost elegant, knife-like implements. Among the latter we find the only ornamental fragment of a tool of bone obtained during the whole course of the excavation. The people who used the splinters of bone for their tools were not so primitive but that they possessed elegant objects of bone, and not so far advanced but that they were often satisfied with such primitive implements as common bone splinters. But both classes of these typical tools are markedly different from what the upper strata of the mound offer in the line of implements. Hence the people of the lower strata must have represented a somewhat different mental type or a different degree of mental training.

It seems advisable, from what we know, to separate the older inhabitants who had settled here and raised the foundations of the mound up to the middle part of the VIIIth stratum, from the later population of the grave period. They may have been neolithic, they may have been connected with the following generation by some common traits, although there is little evidence for this; but the two people certainly differed in cultural characteristics.

The race that commenced building in the middle of the 8th stratum was apparently less different from the population of the upper strata than from its predecessors. But differences can here, also, be discovered. The chipped tools of local materials still continue for some time (about to VII*a*), and obsidian seems to have come to them as a rather rare material. Only a few bone implements from grave 8 are extant in this group of strata. Contrasted with the usage of the people of the upper strata is also the use of bone arrow blades, which the last inhabitants of the mound apparently did not possess. They had not yet departed from an extended employment of bone as a working material; a fact usually more characteristic of a primitive people than of one further advanced.

One observation should still be made in this connection. It is a striking fact that in the fifth stratum and its immediate proximity a number of objects appear, the likeness of which was not found elsewhere in the whole mound. They are:

(1) Fragments of metate-like stones, stratum V.
A long, dull, chisel-like tool of horn, from stratum V.
A tablet of slate polished on one side, stratum V.

(2) Pieces of antlers, truncated for use as tools, stratum V, and a knife-like implement, stratum V.

It seems possible that such sporadic types of tools were left by a people that only temporarily inhabited the mound. Since, however, up to the present time parallel investigations have furnished but little material, such an hypothesis cannot be tested as to its exactness; nor is it possible to state from what region they might have come.

PART II.—ARTIFACTS UNEARTHED AT THE EMERYVILLE SHELLMOUND.*

The artifacts, complete and fragmentary, unearthed during the excavation of the Emeryville shellmound are of stone, bone or horn, and shell.[62] In number, the objects of bone and horn about equal those of stone, or if the large quantity of chipped stone in the lower strata be deducted, being mainly workshop chips, the bone specimens are even in the majority. Although shell heaps usually abound in bone implements, the large number of such implements recovered in this mound is quite remarkable, especially since the mound at West Berkeley, only two miles distant, seems to possess a much smaller number of them. There the bone implements recovered bear the proportion of from 1:5 to 1:10 of those of stone, so in the case of bone implements we find verification of the observation regarding the less frequent occurrence of the bones of animals as waste in proportion to other waste.[63] The occupants of the West Berkeley mound being essentially fishermen, apparently gave less time to the chase, and as a result may have neglected handicrafts in which bone implements were used.

A. Implements made of Stone.

a. Made by Grinding.

1. Mortars.

Stone mortars were among the most common and most useful implements that the ancient inhabitants of the land possessed, being used for the preparation of meal and for other purposes.

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* For the final literary form of the second half of this paper P. E. Goddard is responsible.

[62] Remains of pottery are found in quantities in the shellmounds on the Atlantic Coast (cf. Abbott, *l. c.*, p. 43*a*), and also in those of other localities (Brazil, Peru). They do not, of course, appear in California shellmounds since stone pots and baskets were used in their place at all times.

[63] The specimens of bone implements recovered in shellmounds are of great importance in the study of the use of such implements among primitive peoples, since they are so rarely found in other fields of research (cf. also Abbott, *l. c.*, p. 205). Still shellmounds greatly differ in this respect. While bone implements are ''quite abundant'' in the shellmounds of New England, the same as here (Wyman, Am. Naturalist, I, p. 581), the mounds in New Jersey yield only one bone to every 3,000 stone implements. (Abbott, *l. c.*)

for the pounding up of substances which were used only in small quantities, such as color pigments. The width of this mortar is $2\frac{1}{2}$ inches, its height and thickness $1\frac{7}{8}$ inches. Powers presents a view of a similar specimen from California, a proof that this type occurred in this region. A fragment, 1–8810 of the collection from stratum VIII, may be the bottom of a similar utensil.

4 5

Fig. 4. About one-half natural size. Fig. 5. $\times\frac{3}{4}$. Small mortars.

Some additional types of mortars are represented among the fragments; they will be given below in the order in which they were recovered. 1–8594, fig. 6, from stratum II, is one of several fragments of this stratum and belongs to a relatively advanced type, resembling a vessel. These stone vessels had a fairly even thickness of the sides of about an inch, and were fashioned quite regularly without and within. This rim is flattened and slopes inward. The diameter of the complete mortars may have been a foot. This type of mortar is quite common in California. The collection from Santa Rosa Island in the University Museum made by Dr. Jones contains several similar specimens. 1–8707 fig. 7, stratum IV, is an odd fragment. Its well fashioned bottom part is surrounded by a rim which in turn is bordered by two chambers which exactly correspond: the surface between them is broken. This fragment may also have been part of a mortar, although it is not possible now to restore it to any shape represented among the familiar types. Fig. 8, 1–9077, shows a fragment of a mortar recovered in the Xth stratum, and it is the only one found lower than stratum VIII. It lay hardly an inch from the base of the mound. It has a peculiarly jagged shape; the

The small fragment, 1-8621, fig. 10, stratum II, has to be included also in the class of mortar-like utensils. It is made of a soft material resembling steatite, it curves as if it were a handle and is broken off at one end, while the other rounded end shows marks of blows. This object may be compared to the handle of the cup-shaped vessel of steatite from Dos Pueblos in Southern California and shown by Professor Putnam, l. c., pl. VI, fig. 5 (cf. l. c., p. 110). Similar utensils from Santa Catalina Island and other places are mentioned there; hence it may be assumed that this type of utensils was used by the occupants of the mound during its last period.

Fig. 11, 1-8533, from stratum I, shows a stone fragment, hollowed out like a mortar. The upper rim of the specimen must have had a sharp angle, as the outer surface is almost vertical while the concavity is rather shallow, forming a cup with a considerable diameter.

11

12

Fig. 11. × ⅓. Fragment of a mortar. Fig. 12. × ⅓. Fragment of a stone used for grinding.

2. Flat Stones.

It is only from three small fragments that the presence of this type within the mound may be inferred. All three were recovered in stratum V; one of them, 1-8751, is shown in figure 12. Judging from the fragments, these grinding stones were square in shape, about 1½ to 2 inches in thickness and were worn smooth, both on the horizontal surface and on the sides and ends. The occurrence of flat grindstones is not unprecedented in California; some have been found in Sonoma county[66] and elsewhere. They were perhaps used in the manufacture of shell ornaments and beads.

[66] Moorehead, *l. c.*, p. 291.

New Jersey, Pennsylvania,[69] on the Aleutians,[70] and elsewhere. Abbott has pointed out the fact that the edges of some of these stones could not very well have been used for hammering since they do not show the signs of such usage. The stone in question was evidently used in two ways,—as a hammer at the lower flat surface, which is from five-eighths to 1⅛ inches wide and in this case provided with indentations serving for the insertion of the finger; and as a hammer at the flat sides for the driving of stakes, etc., in which case it was grasped by the rims. The pits in the depressions were probably the result of this latter use of the implement. The writer has noticed that just such flat stones were used in Bolivia for the driving of stakes, and there, too, the broad side which gave the blow was pitted. The material used is hard sandstone.

5. Flat Stones Pointed at both Ends.

Two objects of this form, coming from stratum II, represents a new type of implement. They are almost identical in shape. One of them, 1–8604, is shown in fig. 19. They consist of long, flat, quadrangular boulder-stones, 3⅝ and 3⅞ inches long, with an even width and thickness of 1⅝ inches. Both ends are simply sharpened to a point, and the broad sides, top and bottom, are shaved off as far as the middle of the stone. In form, the stones are similar to a wooden top of today.

6. Sinker-like Stones.

Stones of this description form a large class, exhibiting, however, great diversities of shape. They all seem to have served the same purpose since most of them show indisputable signs of such usage.

About 18 stones of this kind were found in the mound. As regards their varying form and utility, they may be classed as follows:

I. Spherical and oval stones with a peripheral groove: Fig. 20, 1–8669, shows a spherical stone of this kind, found at a depth of 5 feet in cut A. 1–8534, fig. 21, a fragment of an oval stone with a groove about its largest circumference is from stratum I.

[69] Abbott, *l. c.*, pp. 425 to 431, figs. 399 to 404. Chas. Rau, *l. c.* Smithson. Contrib., No. 297, Vol. XXII, p. 20, figs. 80 to 81, and p. 22.

[70] Dall, *l. c.*, p. 55.

2. More or less fragmentary bits, 1–8612, 3, the first without a doubt, the second probably from stratum II. See 1–8613, plate 10, fig. 1.

3. Five fragments of stones of a slenderer, less perfect though similar form, 1–8614, 5 and 6 (plate 10, figs. 5, 3, 8), 1–8617 and 1–8718 (plate 10, fig. 4), the latter one from stratum IV, the others from II.

b. Inverted pear-shaped stones, some flat. This shape is related, though distantly, to the above. Two fragments, 1–8618 and 1–8619, from stratum II, see 1–8618, plate 10, fig. 6.

c. A conical stone with slanting lower surface (1–8719, plate 10, fig. 7) from stratum IV. It is very similar in shape to the upper part of the pear-shaped stones.

d. A pointed stone, 1–8925, from stratum VIII, plate 10, fig. 9, which is only very distantly related to the pear-shape forms.

These stones belong to that class of objects which have been interpreted at different times as being:

1. Weights for determining the vertical.
2. Weights for weaving apparatus.
3. Weights used in spinning.
4. Weights used for fishing nets or lines.
5. Ornaments.
6. Medicine stones or charms.[71]

A number of articles under class IV (Form IV*a*) are made of hematite.[72] Of the objects under consideration, 1–8925 (plate 10, fig. 9) is made of the same. The use of hematite generally presupposes that an implement is going to be employed as a weight. Since the forms that belong to this class merge into one another in an uninterrupted series, one is justified in assuming that they were all weights.

It is further clear that the shape of the pear-like stones, which have caused so much speculation, must have been fitted for some particular purpose. This is to be inferred from the fact that stones of like shape have been found in widely separated parts

[71] Dr. L. G. Yates, Smiths. Rep., 1886, pt. I, p. 296, further explained in Bulletin of the Santa Barbara Soc. of Nat. History, No. 2; Moorehead, *l. c.*, pp. 249 to 250, etc.

[72] Abbott, *l. c.*, p. 232, fig. 220, from Illinois; Rau, Smith's Contrib., p. 27, No. 101, from Tennessee (cf. for both pl. VIII, fig. 2); Moorehead, *l. c.*, p. 251, fig. 29, from Santa Barbara, Cal.

which were also taken from the same shellmound in Visitacion Valley and which had like forms.[81] If we accept the hypothesis that these stones in general are sinkers, there are of course difficulties in the case of individual stones, that must be explained away. The following peculiarities which appear must be mentioned:

1. Occasional peculiarities in material: Some are not very heavy, some rather soft; and in others the ornamentation either in color, grain, or crystalline markings is so prominent that an ornamental use is suggested. 1–8615, plate 10, fig. 3, seems to be a stone of this description,—the material of which it is made is reddish and fine-grained, and ornamented to some extent.

2. The occasional absolute lack of any contrivance by which the implement might have been suspended: 1–8925, plate 10, fig. 9, is, for instance, of this kind. It is for the greater part of its length absolutely round and gradually tapers to a point. The outer end is in the form of a handle which is flattened to about one-half inch wide and one-quarter inch thick and is rough from the marks of blows; the main part of the instrument is smooth. The handle-like part must, from its form and roughness, have served to fasten it by. It looks, however, more as though it were intended to fit into a shaft, rather than to be suspended. It is important to note that one of the long sides is entirely covered with asphaltum. This fact excludes the possibility that it was fastened into a shaft. It must further be called to mind that, as in the case of the California Indian dancing costume, various rod-like bits of stone are sometimes fastened on by means of hangers, the provision for their suspension being made on the stones themselves. The use of asphaltum in securing them often did away with otherwise necessary changes in their form. At any rate it allowed great imperfection in form.

Fragment 1–8616, plate 10, fig. 8, is an example of the above; it is pear-shaped and the upper conical point is encircled by a broad band of asphaltum which served for its attachment.

The sinker-like stones of classes I-III present fewer difficulties in their explanation than do the pear-shaped and kindred ones.

[81] Journal of the Anthropological Institute, *l. c.*, p. 489.

from Illinois with plastic ornaments, as a sinker.[89] Compare this with a picture of a pendent stone from San Clemente Island.[90] The fact that these stones are ornamented seems to make their use as sinkers doubtful but not impossible, since fish-hooks are sometimes much ornamented.[91]

Plate 12, fig. 8, 1–8630, is somewhat sinker-like, but in many respects it diverges from the general class. It is made of very light, soft stone, and is an elongated oval in shape, with five grooves parallel to one another cut in about the edge. It is elaborately ornamented with oblique hatch-like lines on the edges between the grooves. Hence it is improbable that it was a sinker —it cannot, however, as yet be assigned to another use.

7. Cylindrical Stones.

These differ from the pestles in that their diameter is smaller and that they bulge out only slightly toward the middle. Two objects of this kind came from stratum II, of which 1–8609 is shown in plate 10, fig. 10. Both are broken at their ends. They are respectively $4^{13}/_{16}$ inches and $2^{5}/_{8}$ inches long and fifteen-sixteenths inch and 1 inch thick. The surface of the break in the shorter one was subsequently smoothed off; perhaps by using it as a pestle. Long cylindrical stones of this kind partly flattened on one side and having encircling grooves at the tapering ends have been pictured by Yates[92] and Moorehead[93]; these were found at Santa Barbara, Southern California. To these may also be compared a stone pendant from Tuolumne county[94] pictured by Moorehead, since the lack of complete ends in the stones gives considerable room for speculation as to what the whole form might have been. On the other hand, the tentative designation of them by Moorehead and Yates as charms is in no way justified. The better interpretation of their use would be that of sinkers especially in the case of those provided at both ends with grooves

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[89] *l. c.*, pp. 398 and 234.

[90] Putnam, *l. c.*, p. 209, fig. 81.

[91] Among the Thlinkites conys Niblack.

[92] *l. c.*, pl. IV, figs. 32, 33, so. Smiths. Reports, 1886, I, partly, pl. IV, figs. 32, 33, pp. 296 to 305.

[93] *l. c.*, p. 251, fig. 381, Nos. 30 to 33.

[94] *l. c.*, p. 249, fig. 380, No. 1.

Plate 12, figs. 3*a* and 3*b*, 1–8623, is the only representative of the second type. It is made of green serpentine, and is two and one-sixteenth inches long, tapering into a tubular shape. The hole in the stem is as above, only at the mouth end it is conical and shorter. A groove is cut into the tapering end.

Plate 12, figs. 1*a* and (in section) 1*b*, 1–8624, is made of soft gray stone and is very similar to the preceding one, except that it lacks the groove at the mouth end and that it is shorter and thicker.

Plate 12, figs. 4*a* and (in section) 4*b*, 1–8626, is a small cylindrical object only nine-sixteenths of an inch long and seventeen-thirty-seconds of an inch wide. The seven-sixteenth inch conical hole takes up nearly the whole width of the stem so that the rim surrounding it is sharp. The short conical boring at the stem end is only five-sixteenths of an inch wide. The proof that this too was used as a tobacco pipe lies in the fact of the disparity of the two conical borings and in that the entire width of the bowl end of the pipe is used to the best advantage. It seems to have been more of a miniature or toy than an article in common use. However, the quantity of tobacco needed to fill any of the pipes could not have been great since the cone-shaped cavity in the bowl is so small. One is here reminded of Schumacher's entertaining description of the way in which a Klamath tipped back his head in order to raise his pipe vertically that he might lose none of the tobacco. The stem ends of the pipes are equally imperfect. They must certainly all have been fastened to a pipe-like mouth-piece similar to the stone pipes which Professor Putnam has pictured and described and which when unearthed still had the mouth-pieces attached by means of asphaltum.[98] Some Indian pipes of today are fastened to the mouth-pieces by means of ligatures,[99] as was evidently the case with pipe shown in plate 12, fig. 3, and with another one of the collection (1–8625) the stem of which had been broken. A rude notch was cut into the outside of the stem to facilitate the rebinding and to give it a better hold. At any rate, the means of attaching the mouth-piece (comp. particularly figs. 1 and 4) was as inadequate as was the receptacle

[98] *l. c.*, pl. IX.

[99] Powers, *l. c.*, fig. 43, opp. p. 426.

the size of implements, but relatively few (about one-fourth) complete tools.

The obsidian implements came from the Ist to the IXth strata, but most of them were found in the upper layers. Nearly three-fourths of them were taken from the three upper strata. In stratum II alone there were ten implements and one piece of obsidian in the rough. It can certainly be inferred that the great quantity of obsidian tools from II was connected with the custom of burning the dead and of casting their belongings into the flames. In addition, the great number found here shows a broader and more universal use of obsidian in the making of implements.

They are all of very simple form, such as arrow- and spear-heads,[112] spear-like points and a flat knife-like blade, made from the rough stone by polishing off bits[113] (see plate 10, figs. 11 to 16). Arrow-heads of obsidian were found only in stratum II, comp. 1–8676, plate 10, fig. 13, the blade-like knife, 1–8633, fig. 11, and the spear-like knife end, 1–8634, fig. 16, which were found there. 1–8926 from stratum VIII, fig. 15, may have been either a spear-head or a knife. Fragment 1–8536 from stratum I, fig. 12, by virtue of its two unevenly arched surfaces, and 1–8883, fig. 14 of the plate, from stratum VIII (found nineteen feet down in the tunnel between parts 8 and 9 of the shaft frame) on account of its long peg-like lower end, may be parts of knife-like implements. They were fastened on rod-like shafts similar to the fine-handled knives of southern California shown by Professor Putnam and which are in an excellent state of preservation.

From a technical standpoint, it is worthy of note that implements of such perfect workmanship as figs. 12[114] and 13 were not found among the obsidian implements of the lower strata of the mound. A proportional decrease in obsidian implements of good workmanship can be noted as one approaches the lowest strata.

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[112] For the use of spears in California comp. Powers, *l. c.*, pp. 221, 321, etc.

[113] No decorative or fantastic shapes were found among the obsidian objects as elsewhere in central California. Moorehead has shown some of these in *l. c.*, p. 262. A curved hook-like object was found in the shellmound at Ellis Landing.

[114] Moorehead, *l. c.*, p. 265.

very noticeable that because of this crudity in most of them, the line between implement and waste is very vague. It was therefore difficult to decide in the case of many objects whether they were to be regarded as tools at all. On the other hand, it is probable that a number of pieces included under rubbish may have really served as tools.[117]

Resulting from the discovery of obsidian, plate 10, fig. 15, chipped stones of good workmanship were found as far down as the upper part of stratum VIII. It is extremely doubtful whether they appeared at all in the strata below this. The objects made of material from the vicinity of the mound were certainly made during its settlement. A characteristic mark of the uniform crudity of all of these tools made of local materials and found in the lower strata is that they all are worked from but one side and that the elaboration of that side is accomplished by but a very few strokes. The only exception to this is the point, from stratum VII, pl. 6, fig. 19, which as to technique belongs in another place. Pl. 6, fig. 18, 1–9012, shows a ridge-like elevation on its lower side, thus forming an unimportant and superficial exception. The point, 1–8929, pl. 6, fig. 20, is also entirely even on its under side. In this they have a peculiarity characteristic of the well-known "turtle-backs."[118] This latter kind which in the eastern states of the United States has been found typical of the implements of the palaeolithic age is to be recognized in two objects in our collection, 1–9095, of green chert, pl. 6, fig. 2, from stratum X, and 1–9007 of a crystalline substance, pl. 6, fig. 1, from stratum IX. The first of these is without a doubt an implement, and the second is probably one. The palaeolithic turtle-backs of the East are unmistakably to be differentiated from the two objects under question in the material of which they are composed, which is argillite. In any case, however, the presence of these two objects proves that primordial species of stone implements existed into the neolithic period (for the mound rests on alluvial soil) and they may give ground for the estab-

[117] Comp. a similar remark in Abbott, *l. c.*, p. 93, concerning the doubtful nature of chipped stones as implements; from the stones in their vicinity they were conjectured to be implements.

[118] Cf. Abbott, *l. c.*, pp. 492 ff., and the same, Report of the Peabody Museum, 1876 to 1879, II, p. 33 ff.

lishing of the period from which such implements date, which is even farther back than that. The conical piece of jasper brought to a point by chipping, 1–8851, pl. 6, fig. 3, from stratum VII*a*, illustrates how implements were made by chipping from larger pieces of stone, and may even be itself a tool. It cannot be stated indisputably that the greater number of the common forms of chipped stones shown on pl. 6 were obsolete among the latter inhabitants of the mound. But it must be noted that the greater number and the most characteristic of them do not appear in the upper strata. We may surmise that as far as they did occur among the founders of the upper strata they had a better form. In addition to the pointed (pl. 6, figs. 19 to 20) and knife-like implements (fig. 21) the following important types are represented.

1. Long scrapers sharpened on one side, 1–9012, fig. 18, from stratum IX, and 1–9093, fig. 17, from stratum X.

2. Chisel-like tools terminating in front in a straight sharp edge. 1–8857, fig. 14, from stratum VII*a*, and 1–9080, fig. 15, from stratum X.

3. Scrapers, more or less rounded off or oval, 1–9023, fig. 8, from stratum IX, 1–9053, fig. 9, from stratum IX, 1–9085, fig. 10, from stratum X.[119]

In a like manner the following irregularly shaped objects might have been used as scrapers.

1–9043, fig. 7, from stratum IX.

1–8966, fig. 11, from stratum VIII or IX.

1–9012, fig. 12, from stratum IX.

1–9040, fig. 13, from stratum IX.[120]

4. Oval stones with high "turtle-back" backs with the encircling edges sharpened, probably too large for use as the usual scrapers:

1–9007, fig. 1, and 1–9095, fig. 2 .

5. Drills or awl-like, pointed stones, with a more or less thick base.

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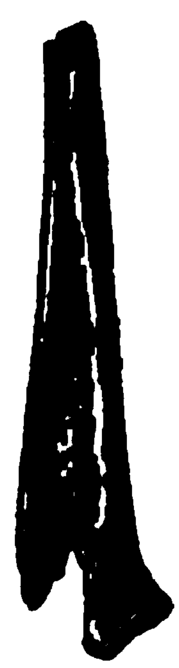
[119] A hide-scraper fastened into a wooden shaft from the Thuswap Indians in British Columbia in the Jessup collection shown by Moorehead, *l. c.*, p. 255, fig. 388.

[120] Pictures of scrapers, see Abbott, *l. c.*, pp. 12 to 138.

and 4, the foot-like supports are missing; whether originally they were there or not is a question. They seem to have been missing from the very beginning, at least the one shown in pl. 9, fig. 3. The whole shape of the instrument is crude. In several awl-like implements of the lower strata, as in text-fig. 25, 1-8797, from stratum VII, the canal in the bone is not even opened, but kept intact through the whole instrument.[128]

b. Blunt awl-like implements.



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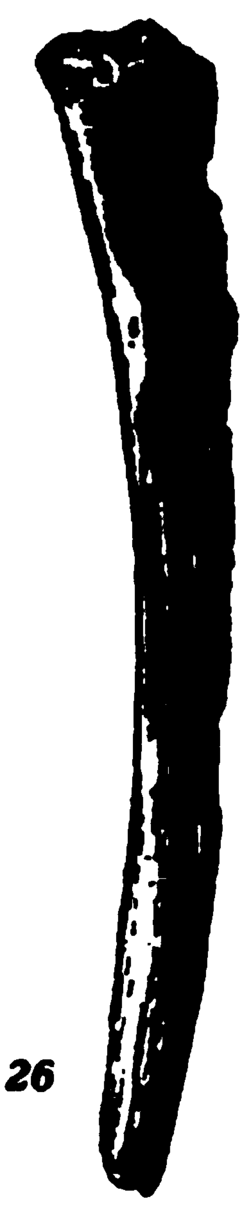

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Fig. 25. × ½. A bone, probably used for an awl. Fig. 26. × ½. Bone implement of unknown use.

[128] Numbers of awl-like bone implements of this kind coming from the United States have been depicted. For those from California, see H. H. Bancroft, Native Races, IV, p. 711, No. 1 (the other so-called tool, No. 2, is a natural bone without value as a tool); Moorehead, *l. c.*, p. 271, fig. 410; F. W. Putnam, Rep. of U. S. Geogr. Survey, *l. c.*, pl. XI, figs. 13 to 15 and 19; p. 227, fig. 104; Nadaillac, *l. c.*, p. 49, fig. 15 (not very useful); from the southern states, for instance, Ch. C. Jones, Antiquities of the Southern Indians, 1873, pl. XVI, fig. 1; Moorehead, *l. c.*, p. 142; Chas. Rau, Smiths. Contrib., No. 287, p. 64, fig. 238 (Kentucky, Tennessee); from shellmounds of New England; Wyman, Am. Naturalist, I, pl. 14, fig. 5, and pl. 15, fig. 9 (both repeated in Abbott, *l. c.*, p. 213, figs. 199 and 202), from New York; Schoolcraft Archives of Aborig. Knowledge, 1860, II, pl. 49, fig. 3, with p. 90, from the Aleutian Islands, Chas. Rau, *l. c.*, fig. 236.

Fig. 28, 1–8541, from stratum II, has a peculiar shape; it is broad, in the form of a channel and pointed. One of the edges of the channel seems to be worn smooth through usage. The back end is broken off.

2. Needle-like Implements.

They differ from the awl-like implements in that they are intended not only to pierce an article but also to pass through it. In this class there are also secondary shapes.

a. Straight needles without perforation.

1–8895, pl. 9, fig. 8, found twenty-seven feet beneath the surface in stratum VIII, may be taken as the prevailing type. The needle is a thin, pointed instrument, oval in cross section, blunt at the back end, well finished throughout. To this class also belongs a number of fragments found in different strata up to the VIIIth.

b. Curved needles.

1–8901, pl. 9, fig. 9, from stratum VIII, represents this type. The needle is very slender and thin and of good workmanship. Unfortunately it is broken off at the smoth posterior end.[130]

c. Needles with "eyes."

We have also only one specimen of this type, 1–8735, pl. 9, fig. 10, from stratum V. It is straight, round in cross section and tapering at the perforated end.[131] The bluntness of the point must be the result of use.

d. Long crooked needles.

1–8831, pl. 9, fig. 7, a well preserved and seemingly perfect specimen, was found in stratum VII*a*, in the tunnel, from eleven to fourteen feet below the surface. It consists of a long, thin rib pointed at the stronger end, thereby exposing the canal within.[132]

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[130] Comp. the objects found in a shellmound in New England, Am. Naturalist, I; pl. 15, fig. 17; it, however, is broader.

[131] A similar needle from a mound in Ohio has been shown by C. L. Metz and by F. W. Putnam, Rep. of the Peabody Museum, 1880 to 1886, III, p. 452. The Point Barrow Eskimos use a similar one (J. Murdock, IXth Ann. Rep. of the Bur. of Ethnology, 1887-88, p. 318, fig. 325).

[132] It reminds one somewhat (in that it is curved and pointed) of an instrument designated, and that manifestly wrongly, by Moorehead as a hairpin (see Moorehead, *l. c.*, p. 271, fig. 410, under No. 4). Jeanne Carr tells of needles made usually of the strong wing bones of the hawk, used to keep the strands in place when the basket-weaver left his work. These were handed down from mother to daughter generation after generation and regarded as valuable possessions. (The Californian, 1892, No. 5, p. 603.)

the same use as these forms just mentioned. Objects like 1–8980, pl. 7, fig. 5; 1–8996, pl. 7, fig. 9, and possibly also 1–8871, pl. 7, fig. 2, have such broad and blunt ends that for them characterization as "awl-like" would be entirely unsuitable and their use must be explained in some other way. The tie that holds them together is, therefore, in no way that of similar use but rather of analogous origin. They comprise a large number of implements having different uses. What is common to them is the similarity of the way in which they were obtained. Their use was determined by the chance form which they thereby received. There is before us then a class of the most primitive ethnological implements of which we have knowledge, in which, as in the oldest known implement of the human period, the natural form of the object determines the use, rather than the use the individual form.

4. Implements of the shape of paper-cutters.

It is natural that in so large a number of bone implements this shape also should be represented. Five belonging to two different types have already been discussed under the grave finds. Altogether the amount of material of this character obtained from the upper strata of the mound is remarkably small. Only a small number of fragments were found, of which only a fragment of the point, 1–8803, from stratum VIII is represented in fig. 29.

In the deeper strata the case was entirely different. There are from these layers no perfect implements, only fragments, but their number is in proportion to what one would expect, or even greater. Some of these show a variety of form and a degree of ornamentation which was hardly to be expected among the finds of the mound in general and least of all among the specimens obtained from the lower strata. Little as the well formed implements, which the fragments figured in pl. 7, figs. 11-17, represent, appear to resemble the rough awl-like implements on the same plate and which have been derived from the same strata, there is yet no doubt possible that the two classes of implements must have been used by the same people.

We have therefore the task, instead of denying the contrast, of suggesting some solution for it.

small bar of bone, 1–8975, fig. 18, stratum IX, as it also comes from this stratum. This is likewise an uncommon form of implement. It is small and well worked, although not of the paper-cutter type. It is oval in cross section and has a small paper-cutter-like lower end which shows that it was fastened to some other object. Its upper end is broken.

5. Pointed Implements.

In the middle strata of the mound there were found about eight pointed bones, of which the types are figured in pl. 9, figs. 11–16.

1–8869, pl. 9, fig. 11, stratum VII, is 2⅛ inches long, oval in cross section and having an inferiorly constricted neck. There is a small hook on the lower end of the broad side. A small fracture on the opposite side appears to indicate that there were originally two such hooks.

1–8868, fig. 12, stratum VIII, is two inches long. This specimen is in general similar to the one just mentioned. There is only one hook at the lower end. The side opposite is without a hook and is unbroken. Similar is 1–8738, from stratum V. An analogous object is figured by Moorehead, page 273, fig. 412, No. 3, from Stockton Channel.

1–8916, fig. 13, stratum VIII, 2 inches long, is similar to the last with the differences that the small broad, flat hook points toward the broad side, and that the pointed end has been smoothed by use. On this end there are also small traces of asphaltum which indicate that a cord had sometime been wound about it to fasten it to some other object.

1–8917, fig. 14, stratum VII*a* or VIII, 1$\frac{7}{16}$ inches long with a rounded cross section, is slightly curved and gradually narrows towards the lower point. The convex side shows a slight flattening.

1–8870, fig. 15, stratum VII*a* or VIII, is 1½ inches long, but the lower end is incomplete. The cross section is oval to flat; it shows on the broad side a sloping groove.

1–8694, fig. 16, stratum IV, an implement 2$\frac{3}{16}$ inches long, is typically knife-like in its form in so far as it has a broad blade-like part. It is sharp on one side, blunt on the other and rounded at the upper end. It is bent well backward. At the lower end it

arrow points of stone. In a certain way these arrow points may possibly be considered as a middle form between long bone points provided with barbs, such as were used by the Eskimo, and the Indian arrow points of stone. In this connection it is worth noting that Mr. Meredith finds them in association with such bone points (also with a lip-plug such as are used on the northwest coast of America). The form of the Indian stone arrow-heads might have been imitated in the North in other materials.

That the analogy with the more northerly races is not limited to the burial layers of the mound from which the pointed implements, pl. 9, figs. 11, 15, were found is indicated by the object, pl. 7, fig. 12, which was found in the cremation layer, No. 2.

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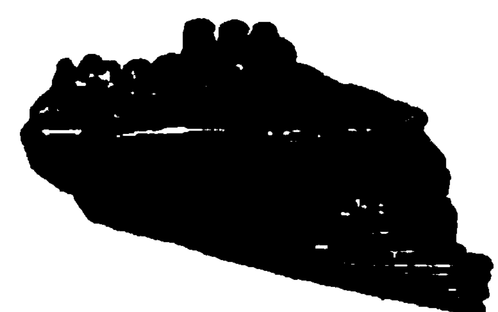

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Figs. 30 and 31. × ½. Notched bones perhaps used in net-making or weaving.

6. Saw-like notched bones.

The excavations furnish twelve objects of this type of implement, of which perhaps half were from stratum II. The remainder were found from the lower strata up to the eighth. Quite a number of the objects from stratum II were calcined, an evidence that they were deemed of value in life since they were burned with the dead.

The best preserved type of this implement, of which in most cases only small fragments were found, is shown in 1–8898, pl. 9, fig. 17, stratum VIII.

Nearly all of these objects have a stereotyped form, being made from the shoulder blade of some large mammal, probably the deer. One, however, seems to have been made from a bird bone (1–8900, fig. 30, stratum VIII). On the specimen shown in pl. 9, fig. 17, about half of the length is taken up by the rounded handle, using the ridge-like end of the bone for this purpose. The other end of the object is incomplete, but according to the

Another saw-like toothed bone implement was found in the cave dwellings in Franconia (Bavaria), which were inhabited in the early neolithic period. This has been described by Ranke as probably used in weaving.[139]

An implement having almost identical form as this just described above was figured by J. Murdock. This object was obtained from the Pt. Barrow Eskimo and was made of the shoulder blade of a reindeer. He received it as a model of a saw said to have been used before the introduction of iron.

After having made inquiries for the primitive form of the implement, this specimen doubtless was made for him.[140] His paper also contains a figure of another saw-like implement, of about twice the size of the first, made of antler. There was with this a kind of shuttle and a form of weaver's sword with the statement that these three implements had been used in weaving feather girdles. In watching the process of making these belts he had, however, not seen any of these three implements.[141] In the opinion of the writer there is no reason to doubt materially the accuracy of the statements concerning the use of these implements by the Eskimo. It therefore contains the key to the understanding of all the remaining forms of this type of saw-like implements found in the northern region. And this explanation may be extended to the wrongly determined Californian bone saws. In our opinion the bone implement first figured by J. Murdock shows simply that the Eskimo remembered having had such an implement and that they gave to him the impression that it had been used in the way in which the investigator was inclined to think it ought to have been used. It appears that Ranke was on the right track when he supposed the Frankish bone implement to have been used in some processes of weaving. In like manner all of the Californian bone saws agree thoroughly with this supposed use.[142] In California many valuable feather girdles have been made, in the weaving of which these bone implements may

[139] Am. Naturalist, 1868, Vol. I, pl. 15, fig. 15, 583.

[140] Der Mensch, II, p. 558-560.

[141] Ninth Annual Report of the Bureau of Ethnology, 1887-88, p. 175, fig. 147.

[142] *l. c.*, p. 317, fig. 323.

ample, that shown in fig. 33, 1–8877, stratum VII*a*. They are probably not to be considered as marks of dog's teeth, as which these could also be determined, for they are generally very numerous in one place or else they show exceeding regularity as if made intentionally.

The shellmound dwellers did not fail to notice the peculiar character of the tubular bones, which when cut into sections are easily made into small receptacles, similar to the cane plant, which is used in a similar manner by the inhabitants of tropical regions (for instance by the ancient Peruvians). Many such small objects with differing proportions were found, two of which are shown in fig. 34, 1–8922, stratum VIII; and fig. 35, 1–9076, stratum X.

Implements of Antler.

For many kinds of implements antler is particularly valuable on account of its hardness. For this reason a number of implements of this character have been found in the shellmound; they are, however, not so numerous as those of bone. They are usually made of deer or elk antler.

1. Chisel-like Implements.

Of these there are two principal types.

a. Actual chisels.

About half of the objects of antler are to be considered as complete implements. These are shown in pl. 8, figs. 2*a* and 2*b*, 1–8892, stratum VIII; figs. 3*a* and 3*b*, 1–8821, from stratum VII*a*, represent the two subspecies of the same, *viz.*, broad and narrow chisels. The main difference between the two is simply one of size and proportion.

The broad chisels are represented by about ten objects, which belong to the middle and lower strata of the mound only, down to the Xth stratum. Whether this is accidental or caused by other reasons remains undecided. These objects are from four and one-half to five and one-half inches long, to one and three-fourths inches broad, and even as thick as one and one-quarter inches. Oval in cross section, they slightly diminish toward the lower end. Frequently they pass one to two inches above the lower end into the flat, knife-like, one-sided slope, ending in a semi-circular edge about one inch broad. The sloping surface as

for three and a quarter inches in the diameter of the breadth. Its upper end shows the same signs of use with a hammer, while the slanting surface is greatly worn on the sides. This makes it probable that the use of this tool was in many respects different from the preceding. It was possibly used as a lever.

For this also a parallel exists in the form of an apparently identical implement from the shellmounds in Maine.[147] As regards form, certain implements of the bones of cattle found in the caves of French Switzerland are similar to this object. Rauch calls them "leather-cutters" (Lederschneidemesser).[148]

2. Implements of antlers with dull, rounded ends.

Three such objects have been found. One of them is seven and one-eighth inches long, diminishing, horn-like, toward the blunt point. It came from the middle stratum of the mound. It is represented in pl. 8, fig. 7. Another is a young branch of an antler, and the third is a mere fragment. The use of these objects, which were doubtless implements, cannot be conjectured.

3. Pointed Implements.

Only one fragmentary blade exists, about one inch long.

4. Straight, truncated Implements.

Two specimens of this kind came from stratum V of the mound. They are wanting in other parts of the mound. One of them is reproduced in pl. 8, fig. 4. It diminishes, horn-like, toward the lower end. Here it is truncated abruptly, having a breadth of five-eighths inches. Unfortunately the upper end is incomplete. The other implement, 1–8722, is absolutely identical with the one just described.

The collection contains also a fragmentary bone tool, 1–9066, which was found in stratum X. It may have corresponded to the peculiar implement, reproduced by J. Wyman,[149] pl. 14, fig. 3 (with the spiral cuts at the upper end), which was found in the shellmounds of Massachusetts.

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[147] Cf. J. Wyman, *l. c.*, pl. IV, figs. 2 and 2*a* with p. 583. Ch. A. Abbott, who represents the same implement, *l. c.*, p. 211, fig. 196, says Massachusetts probably by mistake.

[148] J. Wyman, *l. c.*, pl. XIV, fig. 1, with p. 582. Cf. also Ch. A. Abbott, *l. c.*, p. 211, fig. 195. The implement is unfortunately represented in both places sidewise in an unfavorable manner.

[149] *l. c.*, II, p. 556.

Implements of Tooth.

Only one object made of tooth was found, *viz.*, 1–8736, fig. 36, in stratum V. It is a bear's tooth perforated at the root, serving the purpose of ornament or amulet, and corresponds exactly to the typical illustration of the one from New Jersey;[150] here Abbott emphasizes the fact that such ornaments were the most common among the earlier and present-day Indians.

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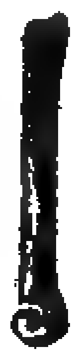

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36

Figs. 34 and 35. × ½. Fragments of bones. Fig. 36. × ½. A bear-tooth ornament.

C. Implements made of shells.

The objects of this material mentioned among the grave-finds are supplemented by two implements, one of which came from the IInd, the other from the VIIIth stratum of the mound. Both are made of the haliotis shell, the material preferred for ornamental purposes by the Indians throughout the country. Recovered in different strata, they differ completely with respect to their form. Yet, owing to the scarcity of the finds we are not permitted to advance the opinion that the form of one was limited in its stratum to the complete exclusion of the other.

1–8632, fig. 37, from stratum II, is about as long as broad, but rounded off at the lower part, while the upper rim is cut off straight. The three-sixteenths inch wide perforations in one row on the upper rim served for the purpose of suspending.

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[150] Cf. F. W. Putnam, *l. c.*, pl. XI, fig. 18.

1–9106, fig. 38, from stratum VIII, represents the broken edge of a larger ornamental plate which was originally triangular or of a quadrilateral shape. The edge is now trapezoidal. Two of the four sides still show the well-worked rims, ornamented with

37

Fig. 37. × ⅓. Fig. 38. × ⅘. Haliotis shell ornaments.

indentations, of the original ornamental plate. The two other sides are rough surfaces of fracture.[181]

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[181] Ch. A. Abbott, *l. c.*, p. 406, fig. 388.

Issued June 15, 1907.

EXPLANATION OF PLATE 2.

Emeryville Shellmound seen from the Bay. The cut made in the side of the mound had been filled when the photograph was taken, but the site of the excavation is seen in the light area on the western slope.


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EXPLANATION OF PLATE 5.

The open cut on the western side of the Emeryville Shellmound.

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RECENT INVESTIGATIONS BEARING ON THE QUESTION OF THE OCCURRENCE OF NEOCENE MAN IN THE AURIFEROUS GRAVELS OF THE SIERRA NEVADA

BY

WM. J. SINCLAIR.

CONTENTS

evidence as is presented by the artifacts and bones preserved. Several months were spent during the summer of 1902 in studying the various occurrences of auriferous gravels in Tuolumne, Calaveras, and Eldorado counties, which comprise the majority of the classic localities where human remains are said to have been discovered. Though the results of the writer's work are largely of a negative character, it is considered advisable to present them as a portion of the general report on the studies on the antiquity of man in this region now being carried on by the department.

The excellent maps of the United States Geological Survey render any general discussion of the distribution and stratigraphy of the gold-bearing gravels unnecessary. As pointed out by Lindgren,[2] the gravels mapped as Neocene by the survey, on the

[1] The Auriferous Gravels of the Sierra Nevada of California. Mem. Harvard Mus. Comp. Zool. Vol. VI, 1880.

[2] U. S. Geol. Atlas, Colfax Folio, Descriptive Text.

atlas sheets of the California gold belt, are of several quite distinct ages with reference to the rhyolitic and andesitic lava flows. "The auriferous gravels proper may be divided into (1) the deep gravels, (2) the bench gravels, (3) the gravels of the rhyolitic epoch, (4) the gravels of the intervolcanic erosion epoch, (5) the gravels of the andesitic tuff." The bench gravels "often contain a predominating amount of quartz pebbles, but no andesite or rhyolite." Those of the intervolcanic erosion epoch "contain pebbles of the Bed-rock series and of andesite and rhyolite."[3] To these may be added a sixth division, the post-andesitic stream gravels which contain pebbles of the Bed-rock series and of all the lavas—rhyolite, andesite, and latite.

It is to be noted that Whitney, while recognizing that the gravels described by him differed in age and in their relation to the intercalated volcanic flows, made no attempt to specify from which gravel the human remains reported by him were obtained, grouping all under the general term auriferous gravels. Some such division of the gravels as that proposed by Lindgren must be kept in mind in the treatment of the question of man's occurrence in these deposits. The lithological characters of the gravels are important in a discussion of the rock types represented in the various implements reported from them.

In examining the region the writer studied the majority of the classic localities mentioned by Whitney and others. Little could be gained by attempting an investigation of all the localities, as in most cases the description is given in such general terms that an identification of the exact localities is impossible. This is particularly applicable to regions of hydraulic mining.

Evidence Favoring the Occurrence of Human Remains in the Gravels.

The evidence favoring the occurrence of man in the auriferous gravels may be subdivided into three classes: (1) human remains reported from hydraulic mines; (2) human remains found in place in undisturbed gravel; (3) human remains from drift mines.

[3] Lindgren, loc. cit.

stone implements and human bones. To one of the latter finds, the so-called Calaveras skull, great interest attaches because the bone has lost its organic material and has taken on the appearance of a true fossil. It has been claimed that the matrix investing the skull is of the same character as the gravel of the mine where the specimen was found.

Review of the Evidence in Detail.

The vast majority of occurrences reported from placer mines can no longer be verified. In addition to the confusion arising from lack of classification as to age of beds involved, Professor W. H. Holmes[4] has shown that there is a strong probability that a large proportion, if not all, of the stone implements reported

[4] Review of the Evidence Relating to Auriferous Gravel Man in California. Am. Anthropologist Jan. and Oct., 1899; Smithsonian Rept. for 1899, pp. 419-472, Plates 1-16, Washington, 1901.

from depths of twenty-five and twenty-nine feet in the gravels at Kincaid Flat. Before mining was begun, these flats were covered with a growth of oaks and were probably advantageous village sites.

The calcareous tufas on the Grant ranch at Gold Springs are all of Pleistocene or recent origin. They have been deposited by large springs, one of which has at present a steady discharge of fifty miner's inches. The tufa deposit conforms to the drainage slopes possessed by the present topography. It is sometimes fine and powdery, but may assume a radiate crystalline and a shelly facies. Intercalated with and underlying the tufa are shallow deposits of subangular gravels which have been worked for gold. These gravels appear to have been formed by the waters from the

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[7] Referred to by Whitney, Aurif. Grav. p. 263, figured by Holmes, loc. cit. Am. Anth. Pl. VI.

[8] Aurif. Grav. p. 257.

same springs which deposited the tufas. There is no available means for determining the rate of accumulation of these deposits. The springs have shifted their points of discharge since the tufas were formed and are not now depositing this substance at a rapid rate. It is of course impossible to determine the nature of the association of the implements with these tufas and gravels, or to locate the place where they were found. The only available information is that conveyed by Whitney and by the labels on Voy's collection. It is known however that Voy obtained his specimens from this locality at second hand, from persons who probably claimed to have found them as described.

The implements from these localities afford no inherent evidence of antiquity. They are of the same type and material as those found on old Indian sites.

Human Relics from Murphys.—The detrital material filling crevices in the limestone in the vicinity of Murphys is also a reputed source of human relics. While some of this material is Pleistocene, other portions are recent and some of it may antedate the Pleistocene. In the absence of detailed information regarding the exact localities where the implements were found, these occurrences may be passed without further comment.

The King Pestle.—The only account of the occurrence of human relics in the gravels which has gone practically unchallenged is that published by Dr. Becker[9] regarding the discovery by Clarence King of a broken pestle in the andesitic gravels and sands close beneath the latite cliff of Table Mountain. The locality is given as that part of the mountain lying a couple of miles southwest of Tuttletown. This would be above Rawhide. The implement was dislodged from hard gravel, leaving behind a cast of its shape in the matrix. The relic is a portion of a pestle of fine grained diabase, the end highly polished by wear in the hand. As a geologist, Mr. King was a reliable observer and able to determine whether or not the implement was in place and formed an integral part of the mass of gravel in which it was imbedded. Secondary cementation does not seem to have been taken into consideration. On many of the outcrops of andesitic sandstone in the vicinity of this locality, secondary cementation is

[9] Bull. Geol. Soc. Am. Vol. 2, p. 193.

History Society and the Philadelphia Academy of Natural Science. The specimen is said to have come from a depth of one hundred and eighty feet, from beneath a series of strata comprising in descending order surface soil, pipe clay, "cement" with leaf impressions and gravel. It was taken from the sluice in which gravel from the mine was being washed. In addition to the bone, a mortar is said to have been found in these workings in the gravel.

(*c*) A white marble bead from the Sonora tunnel. The specimen was taken from a carload of gravel coming out of the tunnel. When found it is said to have been incrusted with pyrite.

(*d*) A mortar from the Boston tunnel, found by Llewellyn Pierce.

(*e*) A human skeleton from a tunnel under Table Mountain. No further particulars are given.

(*f*) A perforated cutting implement and several stone mor-

[*] Loc. cit. Am. Anth., p. 622.

tars from the Stanislaus Co.'s claim at O'Byrns' Ferry, Tuolumne Co. The relics were found "from sixty to seventy-five feet from the surface in gravel, under the basalt and about 300 feet in from the mouth of the tunnel."

For several of these occurrences there are absolutely no data on which to base an investigation, nor any attendant circumstances to establish their validity as evidence. The relics in the Snell collection are lost. No particulars are furnished regarding the skeleton. The implements from O'Byrns' Ferry have not been preserved. The geological features of the locality are essentially the same as those of the more northerly parts of Table Mountain.

The position of the Valentine shaft was sought by the writer, but without success. Regarding the possibility of an external origin for the objects reported from this shaft, Whitney says: "The essential facts are, that the Valentine shaft was vertical, that it was boarded up to the top, so that nothing could have fallen in from the surface during the working under ground, which was carried on in the gravel channel exclusively, after the shaft had been sunk." In this connection it may be pointed out that many of the old drift mines south of Shaw's Flat were connected and that this system of galleries was ventilated by air shafts, so that the possibilities are not limited to one shaft, however securely that one may have been boarded.

The Sonora tunnel is an incline starting in andesitic sands and pipe clay beneath the latite near the intersection of the roads to Tuttletown and to Sonora via Shaw's Flat. It is said to connect with some of the deeper workings under Table Mountain. Little dependence, as an evidence of antiquity, can be placed on the presence of pyrite in the hollow of the marble bead reported by Whitney from the gravels of this mine. The rapidity with which secondary pyrite forms is well known. Calcium carbonate might act as a precipitating agent in salts of iron dissolved in the mine water.

The relics from the Valentine shaft and Sonora tunnel were not found in place in undisturbed gravel, but were taken in one case from the sluice in which gravel was being washed, and in the other from gravel brought out in the car. If this degree of

The label accompanying this specimen, which is No. 6[12] of Voy's coll. (1–4209), places the depth from the surface at 340 feet, 140 feet of which is said to have been basalt.

Mr. Pierce, who resides about a mile above Jeffersonville, Tuolumne Co., was interviewed by the writer. During the course of this interview the following information was furnished by Mr. Pierce. The mortar from the Boston claim was as large as a sixteen-gallon milk bucket and would weigh about seventy-five pounds. It was found in hard gravel under the cement, and was taken out by Mr. Pierce while he was sitting on a candle box, breasting out gravel. The writer was shown a small oval tablet of dark colored slate with a melon and leaf carved in bas-relief. Mr. Pierce claimed to have found this in the same gravels as the mortar, and, he thought, probably at the same time. This tablet

[11] Aurif. Grav. p. 266.

[12] Figured by Holmes, loc. cit. Am. Anth., Pl. VII.

"One of the miners coming out to lunch at noon brought with him to the superintendent's office a stone mortar and a broken pestle which he said had been dug up in the deepest part of the tunnel, some 1500 feet from the mouth of the mine. Mr. Neale advised him on returning to work to look out for other utensils in the same place, and agreeable to his expectations two others were secured, a small ovoid mortar, 5 or 6 inches in diameter, and a flattish mortar or dish, 7 or 8 inches in diameter. These have since been lost to sight. On another occasion a lot of obsidian blades, or spear-heads, eleven in number and averaging 10 inches in length, were brought to him by workmen from the mine. They had been found in what Mr. Neale called a 'side channel,' that is, the bed of a branch of the main Tertiary stream about a thousand feet in from the mouth of the tunnel, and 200 or 300 feet vertically from the surface of the mountain slope. These measurements were given as estimates only, but at the same time they

were, he felt sure, not far wrong. Four or five of the specimens he gave to Mr. C. D. Voy, the collector. The others also had been given away but all trace of them had been lost. Mr. Neale spoke enthusiastically of the size and perfection of these implements, and as he spoke drew outlines of long notched blades in the dust at our feet. Some had one notch, some had two notches, and others were plain leaf-shaped blades."

"Desiring to find out more concerning these objects, he went on to say, he showed them to the Indians who chanced to be present, but, strangely enough, they expressed great fear of them, refusing to touch them or even speak about them; but finally, when asked whether they had any idea whence they came, said they had seen such implements far away in the mountains, but declined to speak of the place further or to undertake to procure others."

The following statements by Mr. Neale regarding the discovery of these implements were taken down by the writer in the course of the interview: A certain miner (Joe), working on the day shift in the Montezuma tunnel, brought out a stone dish or platter about two inches thick. Joe was advised to look for more in the same place. At the time, they were working in caving ground. Mr. Neale went on the night shift and in excavating to set a timber, 'hooked up' one of the obsidian spear points. With the exception of the one brought out by Joe, all the implements were found personally by Mr. Neale, at one time, in a space about six feet in diameter on the shore of the channel. The implements were in gravel close to the bed-rock and were mixed with a substance like charcoal.

The large pestle and mortar mentioned by Becker are in the United States National Museum. The material of the mortar is andesite.

The geological conditions in the vicinity of the Montezuma mine are similar to those at other points along Table Mountain. The detrital deposits beneath the latite are not well exposed, but wherever seen are found to be andesitic breccias, gravels, sands, and pipe clay. The deep gravels lying in the center of the channel are believed to be prevolcanic, so that there is involved the anomaly of two late volcanic rock types, andesite and obsidian, occurring in the prevolcanic gravels.

and, from the opening, penetrates the rim underneath Table Mountain a distance of 742 feet. Mr. McTarnahan himself found the mortar in the gravel, as work was proceeding, 500 feet from the outside of the rim, which, from the direction of the drift, would make it 200 feet from the apex of the rim under the surface of the basalt. He described the mortar as a granite boulder about eight inches in diameter, and the hollow four inches in diameter at the surface and three inches deep." Mr. Frank McTarnahan, who resides not far from the Empire mine, was interviewed by the writer regarding this relic. Both he and Mr. Charles McTarnahan, his brother, worked in the mine together. The only mortar found was discovered back of the lagging during the work of retimbering. The mine had been idle at least two years before the McTarnahans began work. The mortar was not in the gravels, but thrust in back of the lagging, as large pieces of rock and

[18] Loc. cit. p. 451.

* Bull. Geol. Soc. Amer., Vol. 2, p. 199.

boulders commonly are used to fill up space room between the timbers and the wall. It is evident that an implement lying loose behind the timbering of an old mine can not be accepted as indicating great antiquity.

Implements from the Marshall Mine.—Human relics are reported by Whitney from the Marshall mine near San Andreas, Calaveras County. The published statement[17] is in the form of an affidavit, as follows:

San Andreas, Calaveras County, California,
January 3rd, 1871.

"This is to certify that we, the undersigned, proprietors of the gravel claims known as Marshall & Company's, situated near the town of San Andreas, do know of stone mortars and other stone relics, which had evidently been made by human hands, being found in these claims, about the years 1860 and 1869, under about these different formations:

1. Coarse gravel	5 feet
2. Sand and gravel	100 feet
3. Brown gravel	20 feet
4. "Cement" sand	4 feet
5. Bluish volcanic sand	15 feet
6. Pay gravel	6 feet
	150 feet

The above (mentioned relics) were found in bed No. 6."

(Signed) R. D. Hubbard,
John Showalter.

The writer visited this locality and talked with Mr. J. C. Marshall, who was a part owner in the mine with Hubbard and Showalter. The mine is situated on the top of a hill a few hundred feet northwest of the Calaveras County Hospital in the outskirts of San Andreas. The hill is capped by a gravel of the inter-volcanic epoch, partly overlain on the southwest side by a small area of andesitic breccia. There are no outcrops of rhyolite tuff visible, but the tuff appears on many of the old mine dumps and is probably the "bluish volcanic sand" of the section. The pay gravels are probably inter-rhyolitic.

[17] Aurif. Grav. p. 274.

"Clay Hill is one of a series of elevations which constitute the water-shed between Placerville Creek and Big Cañon, and is capped by a stratum of basaltic lava, some eight feet thick. Beneath this there are some thirty feet of sand, gravel and clay. The country-rock is slightly capped on this, as on most of the elevations, the slope being toward the center of the hill. Resting on the rock and extending about two feet above it, was a dense stratum of clay. It was in this clay that we came across the bones. While emptying the tub, I saw some pieces of material which on examination I discovered were pieces of bones; and, on further search, I found the scapula, clavicle, and parts of the first, second and third ribs of the right side of a human skeleton. They were quite firmly cemented together; but on exposure to the air began to crumble."

On examination the geological features of Clay Hill were found by the writer to differ in several respects from the above de-

and tunnels lies beneath the rhyolite tuff, and may be seen in place in the walls of a cut at the southwest end of the hill. The pebbles are largely quartz, amphibolite and schists of the Calaveras formation with an occasional porphyrite, and with the exception of the quartz are quite thoroughly decomposed. They are inclosed in a fine clayey matrix composed largely of rhyolitic ash. In color they are a pale greenish tint. These gravels belong to the rhyolitic epoch. They are exposed in the cut to a thickness of about a foot. Bedrock may be seen a few yards to the southwest, but the contact of the gravel with the bedrock is concealed in the cut by mine dump and talus. There is no trace of calcareous or ferruginous cementation. The pebbles are flatter than those of the upper gravel, but are equally water-worn.

The following section is given by Whitney,[19] as that passed through by Mattison in sinking the shaft on Bald Hill:

[19] Aurif. Grav. p. 269.

1.	Black lava	40 feet
2.	Gravel	3 feet
3.	Light lava	30 feet
4.	Gravel	5 feet
5.	Light lava	15 feet
6.	Gravel	25 feet
7.	Dark brown lava	9 feet
8.	Gravel	5 feet
9.	Red lava	4 feet
10.	Red gravel	17 feet
	Total	153 feet

The various "lavas" are difficult to identify, and are probably not correctly determined. The "black lava" is a rhyolite darker in color and harder than the common white tuff. The shaft was started in this rock a few feet below the contact of the rhyolite tuff and the overlying gravels. The skull is said to have been found "in bed No. 8, just above the lowest stratum of lava."

The matrix of the skull is described by Whitney[19] as follows:

"When delivered into the writer's hands its base was imbedded in a conglomerate mass of ferruginous earth, water-worn pebbles of much altered volcanic rock, calcareous tufa, and fragments of bones. This mixed material covered the whole base of the skull and filled the left temporal fossa, concealing the whole of the jaw. A thin calcareous incrustation appears to have covered the whole skull when found; portions of it had been scaled off, probably in cleaning away the other material attached to the base.

"Nothing was done to the skull to alter its condition in any way, after it came into the writer's hands, until it had been examined by Dr. Wyman, when we together carefully chiselled off the foreign matter adhering to its base . . . . . .

"In cutting away the mixed tufa and gravel which covered the face and base, several fragments of human bones were removed; namely one whole and one broken metatarsal; the lower end of a left fibula, and fragments of an ulna, as well as a piece of a sternum. These bones and fragments of bone might have belonged to the same individual to whom the skull had appertained; but, besides these, there was a portion of a human tibia

[19] Aurif. Grav. p. 268.

present in vacuities in the stalagmite. Small grains of hematite were also detected. Fragments of charcoal and small portions of the shell of a land snail adhere to the stalagmite. The material is dissimilar in every respect to either of the gravels exposed on Bald Hill. In every respect it is comparable to a cave breccia. The association of rock species and the stalagmitic cementation is the same as that found in the breccias on the floors of many caves in Calaveras county which the writer has examined. The lack of agreement between the gravels on Bald Hill and the matrix of the skull effectually establishes the fact that the skull was not obtained in place, as claimed, in the gravels beneath the rhyolite, or from any other gravel of the rhyolitic epoch. None of these gravels exhibit any trace of stalagmitic cementation.

The cave origin of the skull is strengthened by the animal remains and works of art associated with it. In addition to the

bones of a smaller human individual, there was with the skull a shell bead and the bones of a small mammal. Imbedded in the stalagmite investing fragments of the breccia received from Professor Putnam, the writer found the incisor tooth of some small mammal, possibly a bat or a mole, and an amphicoelous vertebra of a small amphibian. This material is not complete enough for generic determination, but there is no reason for regarding the remains as those of extinct forms. The shell bead has been examined by several archaeologists, who state that it is similar to those found on many Indian sites of the coast region of California.

The scarcity of vertebrate fossils in the auriferous gravels is well known to all geologists familiar with these deposits. The abundance of bones, human and animal, associated with the skull is remarkable in the light of the supposed career depicted by Whitney for this relic before it was finally imbedded in the gravels of a Neocene river.* The effect of even a moderate amount of stream action would be to scatter rather than to collect the various parts of a skeleton. The smaller bones would inevitably be ground to powder. The larger bones should show traces of abrasion rather than fresh fracture as is the case.

The caves of Calaveras County present conditions similar to those indicated by the matrix and remains associated with the Calaveras skull. Many of them have served as Indian mortuaries. A good illustration of one of these will be found on plate 14. A heterogeneous mixture of human remains similar to that shown in this photograph would account for the association of the bones of two individuals with the skull. The human bones found in these caves are often coated with stalagmite and have lost the greater part of their organic matter. Animal remains are commonly present in the earth and breccia on the cave floors. Shells of *Epiphragmophora* (*Helix*) are almost always present.

It is supposed by some that the Calaveras skull came originally from Salt Spring Valley. Holmes[20] states on the authority of Mr. George Stickle of Angels, that the skull, together with a companion specimen, had been placed on exhibition in Stickle's store by Dr. J. I. Boone, who obtained it in an Indian burial ground

* Aurif. Grav. p. 272.

[20] Smithsonian Rept., 1899; Am. Anth., p. 634.

It is not the object of the present paper to determine certainly the original place of burial of the skull.* The writer has re-

[a] Jackson Folio, U. S. G. S. Atlas.

* The following note which Professor Putnam has kindly furnished, brings out particularly the fact that the Calaveras skull described by Whitney is not certainly to be identified with any of the skulls which may have been used in attempts to deceive Mr. Mattison or others:

"In 1897 the 'Calaveras Skull' came into the possession of the Peabody Museum from the estate of Professor Whitney, who had expressed the wish that the skull, with all the material pertaining to it, should be given to the Peabody Museum for permanent preservation. I soon realized the importance of making a comparison of the matrix taken from the skull by Professors Whitney and Wyman with the gravel from the Mattison shaft. At my request, early in September 1900, Professor Richard E. Dodge visited Bald Hill for the purpose of obtaining gravel from the layer in which the skull was said to have been taken by Mattison, but the shaft was full of water and the gravel could not be obtained. Mr. Dodge heard several stories relating to the skull such as those that have been reported by Professor Holmes and Mr. Sinclair.

"On September 26-29, 1900, I was in Angels with the hope of making arrangements to have the water pumped from the shaft, but I soon found out that even if this were possible it would be a very long and expensive operation and I therefore abandoned the attempt. While making my examination on Bald Hill I secured the assistance of a Mr. Lee, who had been employed

was a contemporary of the three-toed horse and other primitive forms of the late Miocene and early Pliocene, a thesis to which all geological and biological evidence is opposed.

CONCLUSIONS.

A review of the evidence favoring the presence of the remains of man in the auriferous gravels, compels one to regard it as insufficient to establish the fact. On the preceding pages, it has been shown either that there have been abundant opportunities for the relics in question to be mixed with the gravels accidentally, or that the geological conditions at the localities are such as to render it improbable that the implements and bones have been associated in the gravels to the extent supposed.

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[28] Colfax Folio, U. S. G. S. Atlas. Descriptive Text, pp. 5 and 6.

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See also a department circular, "The Department of Anthropology," University of California, 1905, p. 16, where a statement is made of the results of studies in connection with the Calaveras skull. It was stated that the matrix surrounding the skull is unlike the auriferous gravel but is like material from caves.

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POMO INDIAN BASKETRY.

BY

S. A. BARRETT.

CONTENTS.

basketry. By certain of them, of course, only a limited number of materials, techniques, and designs were used but among others a greater variety was found.

Among no other California people was there so great a variety in basketry as among the Pomo, who occupied the greater part of Sonoma, Mendocino, and Lake counties, and vicinity. It is with the basketry of the Pomo, and particularly with its designs and other ornamentation, that the present paper has to deal. Information upon the general features of Pomo basketry, and to a certain extent upon their designs, was collected during some years of residence in the Pomo region, but it was not until 1904 that an attempt was made to systematically collect and verify all information possible concerning Pomo basketry and basket designs. This work was conducted as part of the investigations of the Ethnological and Archaeological Survey of California

found so frequently on Pomo baskets of the finer and ceremonial types.

The simplest kind of basket is that made entirely of slender willow or hazel stems, either peeled or unpeeled, these being used not only as the warp elements, but also being twined about as woof. Only the coarser open-work baskets, such for instance as fish and quail traps, coarse burden baskets, plate-form or hemispherical baskets used for sifting and as general receptacles, and seed-beaters, are made in this way. In these baskets the same method of manipulation, namely, plain twining, is found as in the brush fences built to snare or entrap deer, elk, rabbits, and quail, or in the brush wiers built across the streams for the trapping or spearing of fish. One type of seed-beater is also made in wickerwork. All baskets other than the coarse open-work ones above mentioned are made of two or more materials, the slender willow or hazel stems always being used as the foundation material.

one being the small inner fiber of the root of the willow, *Salix* sp. So far as has been found there seems to be no very great preference for any one of the several species of willow which abound in the Pomo country, the slender roots which grow out into the water of lakes and streams being taken from all. Some maintain that the best fiber is obtained from the root of the same willow the stems of which are used as the foundation material. This material is sometimes used in the finer coiled baskets, but is chiefly used in twined or in coarse coiled work. It must, however, be counted as one of the materials more rarely used and is said by the Indians themselves to be much inferior to sedge or pine root on account of its brittleness when dry.

The other white material found in use among the Pomo of these three divisions, is the root of what is commonly called the digger pine, *Pinus sabiniana*. Various sized roots of this pine are dug, and after being heated in hot ashes or by holding them directly over the fire, are split into long coarse fibers, which are

upper opening in the mortar or milling basket, as also about the opening of some baskets of the openwork sifter type.

FIBER MATERIALS.

English	*Northern*	*Central*	*Eastern*
Sedge *(Carex barbarae)*	kûhû'm	kūhū'm	kūhū'm
Sedge *(Carex* sp.)	kadī' kûhûm		katsa'-kūhūm
Bulrush *(Scirpus maritimus)*	tsīwi'c	tsīwi'c	tsīwi'c
Redbud *(Cercis occidentalis)*	mille	kala'ia	dīsa'i
Redbud (inner bark)	millê-to'i	kala'ia-katō	dīsaí-tō'ts, tacī'ma
Digger pine *(Pinus sabiniana)*	kale'-ce	kale'-ce	kale'-ce
Juniper *(Juniperus occidentalis)*		catco'm	cato'p
Willow root *(Salix)*	kala'l-yem, ma-yem	ma'-ce	gaii'-ce

feathers of lemon color which are also used in basket decoration.

Next in importance to the red feathers from the woodpecker are the jet black plumes from the top-knot of the California valley quail, *Lophortyx californicus.* These, while they are never used as the complete covering of a basket, are much employed to ornament the borders of feathered baskets as is shown in pl. 21, fig. 2, or to scatter over the surface among other feathers. They are also often used even upon the finer twined baskets without other feathers as is shown in pl. 16, fig. 6. The plume of the male is much longer and is more highly prized than that of the female, but both are used. Occasionally also, though it occurs so rarely that this can hardly be counted as one of the regular basket materials, the long slender black plume of the California mountain quail, *Oreortyx pictus*, is used in the same manner as the shorter club-shaped plume of the valley quail.

The green head of the mallard duck, *Anas boschas,* also provides an important material for ornamenting baskets. Baskets

English	*Northern*	*Central*	*Eastern*
Redheaded woodpecker *(Melanerpes formacivorus)*	kata'tc	kata'k	kara'tc
Mallard *(Anas boschas)*	kaia'n	kaia'n	kaia'n
Quail, valley *(Lophortyx californicus)*	caka'ka	caka'ka	cag' a'x
Quail, mountain *(Oreortyx pictus)*	kohō'ī	kohō'ī	
Lark *(Sturnella magna)*	djicī'l	cil	gūcī'lī
Oriole *(Icterus bullocki)*	ka'iyōyū	kaiyōi	tsaga'tsagaū
Red-winged blackbird *(Agelaius phoeniceus)*	bilī'ya	tsilī'	tsū'Lī
California Jay *(Cyanocitta californica)*	tsai	tsai	tsai
Bluebird *(Sialia[3])*	kalītcō'tcō	ta' tsakat	kacī'ltsiya

[3] Two species of bluebird, the Western bluebird, *Sialia mexicana*, and the Mountain bluebird, *Sialia arctica*, are found in this region.

A special weave related to lattice twining is employed in the making of one form of basket, the cradle. As in lattice twining, there are rigid elements running both vertically and horizontally; and like it also, the pliable weaving elements are two in number. The single horizontal rigid element is in all respects the same as that used in lattice twining except that in some cases at least it is semicircular instead of circular in cross-section. The two pliable weaving elements are, however, usually some form of string, though the ordinary weaving fibers are sometimes used. In the case of lattice twining these pliable elements are manipulated as in plain twining, except that in the twining they include not only the vertical elements but also the horizontal one. In the special weave used in cradles, however, these two pliable elements are woven together in a very intricate fashion, the details of which may be seen in pl 15, fig. 7.

In the exact manipulation of the elements used in the various kinds of weaving there are certain differences to be noted. All

upon the bottoms of baskets than is the one where the woof strands include four warp sticks. However, none of the three-strand weaves are in very common use, even as border finish or upon the bottoms of baskets. Probably not more than half of the tightly woven twined baskets have borders or bottoms in which one of the three-strand weaves appears. Among openwork baskets on the other hand the bottoms have no special weaves. The borders are of quite a different nature, being in almost all cases of the warp-turned-down order, with now and then a basket of the sifter type possessing a border bound with a hoop.

TWINING.

English	*Northern Pomo*	*Central Pomo*	*Eastern Pomo*
Twining	djama'	tcama'ū, cee't	kī'ckī
Plain twined	bam-tū'c	bam-tū'c	xai-xa'lī, bam-tū'c
Diagonal twined	cūse't	bam-sa'ı	cūsa's
Lattice twined	t!ī'	bainē'dū	tcīga', tū'ga
Three strand tw.	cītsī'n	cwi'tki	cūwi'ri
Three strand br.	cītsī'n	cwi'tki	cūwi'ri
Wickerwork	djama'!	itī't!	dūka'l

also be used without the above mentioned binding, in which case the twining proceeds as in the case of the warp sticks crossed in pairs shown in pl. 15, fig. 3.

The third method of making the foundation for twined baskets is by means of warp sticks crossed in fours. These sets of warp sticks may be bound at right angles to each other by fibers passing diagonally over the warp sticks and through the angles of the cross formed by these sticks. These fibers may be passed through one or both sets of diagonally opposed angles. The pairs of each four are then bound together with continuous twining fibers, thus serving to further bind the whole eight sticks more securely together. This produces such a foundation as is shown in pl. 15, fig. 5. In addition to this method there is usually another binding in which a single fiber passes at right angles to one set of fours and through the successive spaces between the other set of fours, the rods of which are of course at right angles to the first set and parallel to the direction of this fiber itself. This

warp stem bundles, and in having more than two stems in each group. Most have their warp stems gathered in groups of threes and bent into three rows of warp-twining as in pl. 26, figs. 1, 2; but baskets with as many as four rows of twining and four warp stems in each group have also been found. The essential features of all these methods are the same, but in some, for instance the border with three rows of twining and with warp stems grouped in threes, there is considerable variation in the exact manipulation of the stems. Each group of three warp stems is included between the two bundles of twining lowest down. Into this lowest row of twining bundles, however, one of the stems is often incorporated. A second may be taken up in the next row and the third in the top row. This is the most usual though not the universal method. The other methods found are as follows: All three warp stems may be carried up to the second or even to the top row. In the first case the second and third stems are carried up to the top row and usually the second is here incorporated, the third being cut off even with the top or rim of the basket,

braided and twined warp border there are two methods of disposing of the ends of the warp sticks which remain after the last round of twining is finished. They are usually simply bound down to the edge of the rim of the basket with a willow stem or a piece of string, as is shown in pl. 25, figs. 5, 6, and pl. 26, fig. 3. They may, however, be braided together and the braid bound down in a similar manner, or the braid may be passed down below the lowest row of twining bundles and then passed two or three times in and out among the warp sticks in order to secure it. One notable exception to this careful securing of the ends of the remaining warp sticks to the rim of the basket is found in the double fish trap above referred to. Here these ends are simply bound securely together but are not fastened to the rim itself (pl. 27, fig. 6). At the same point on the basket also the inner and outer parts of it are not attached by having the warp sticks woven into a common border as was above described. On the contrary each has a separate border of bundles of warp

herself, however, it was found that the idea was original with her and that she had made only two or three baskets of this type, so that so far as the Pomo in general are concerned coiling upon a two-rod foundation does not enter seriously into consideration.

Likewise coiling upon a rod and welt foundation is not a typical Pomo process. This method is practiced only by the Pomo of the Northeastern division and is undoubtedly due to the association of these people with the Yuki to the northwest, where this form of coiling is the typical one. Owing to the small number of survivors of this group opportunity has been afforded of examining but a very few of these baskets. Foundations of three rods and one welt, and foundations of two rods and four welts have been found.

In connection with coiled basketry the method of starting the foundation should be noted. In nearly all baskets where the coiling proceeds in concentric circles, that is, in all coiled basketry except the elliptical or so-called boat-shaped form, the

new sewing fiber is made by passing the end of it under the one or three rods of the coil and drawing the fiber inward toward the inside of the basket until the end is just hidden from view from the outside. The sewing element already in use is then passed for the last time through the coils in the regular way. This element includes all the rods of the coil which is just being added and also one rod of the coil next lower so that as it binds the new and the old coil together it holds the newly inserted element very securely between the two coils. The old sewing element is then cut off just even with the inner surface of the basket, the newly inserted sewing element is taken up, and the coiling and sewing progress as before. The insertions as a result of this process are in many cases scarcely discernible on the inner surface and never so on the outer surface of a basket.

So far as the finishing of Pomo coiled basketry is concerned, the last coil about the opening is made in the same manner as all

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[2] Op. cit., pp. 250-253.

siderably rounded. Further, one side of the basket is also flattened, this being the side designed to rest on the back. By some informants it is said that this flattening is intentional and that the baskets are woven thus, but by other informants it is said that the flattening comes through use. Inasmuch, however, as in most new baskets this flattening appears, it seems probable that the former explanation is the correct one.

Forms approaching a truncated cone are quite common among the coiled baskets, but do not occur in twined ware. This form may vary from a true truncated cone to forms with very much incurved and others with very bulging sides. In all cases these truncated cones rest upon the smaller end as a base, the upper, larger end being entirely open. Examples of baskets of this general form are shown in pl. 18, fig. 2, and pl. 19, figs. 1, 2.

Hemispherical baskets of several kinds are also found. In this form both coiling and twining are used. Most notable among

[8] Present series, VIII, 49, 50, 1908.

made in the same weaves as the spherical.

A special form of basket is that resembling the spheroidal, but with a decided narrowing just above the flat base, so that it presents the effect of a spheroid slightly raised from the supporting surface. But very few of these baskets have been seen and these were all in three-rod coiling. The Indians say that this form is not an aboriginal one, but has been made at the request of the whites. The same is true of one or two baskets seen which had a pedestal or foot resembling that of a goblet or cake stand.

Elliptical or so-called boat-shaped baskets, such as those shown in pl. 20, and pl. 19, figs. 4-6, occur in the two methods of coiling and in almost every variation of form, from globes with slightly compressed sides to very narrow and long baskets. In some the opening, always elliptical, is almost as large as the body of the

One other form of basket found among the Pomo is the seed-beater with a handle (pl. 24, fig 1). This is usually made in wickerwork, the only basket made in this weave by the Pomo. Wickerwork is of rare occurrence on the Pacific slope and has not heretofore been reported from California. While this is the typical form of Pomo seed-beater there is another made by the Pomo living in the extreme northern part of the territory of the Northern division. As shown in pl. 24, fig. 4, this is quite conical, made in plain twining upon radial warp sticks, and with a handle consisting of a number of sticks inserted in the interstices at intervals from the conical point to the edge along one side of the basket. To these are added the few warp sticks covered by and immediately adjacent to them and the whole bundle is bound with grape vine or other binding material. A notable feature of the handle is the manner of this binding, which consists in all cases of an ordinary wrapping near the base of the handle and then a sort of spiral tying, along the rest of its length. The binding

pattern in the feathers themselves, their use being chiefly secondary to the pattern worked out in the fibre. Often the red feathers of the redheaded woodpecker are scattered at frequent intervals over the white part, or what may be considered the groundwork of the basket; they thus outline and bring more prominently to notice the pattern which is worked out in black, or sometimes red, fibre material. At other times these or other feathers are scattered in this manner over the entire surface of the basket regardless of the pattern. However, where the surface is thickly covered with feathers the designs which are worked out in the feathers are of course the same as the designs in the fiber materials of the baskets, although on account of the nature of the feathers it seems impossible to make other than simple patterns. At any rate the more difficult pattern are never found.

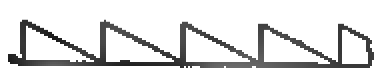
Pomo baskets, as before mentioned, are made of fiber materials in three colors, white, black, and red. It is almost invariably the case that the white material is used as a background

As regards the single and three-rod foundations of coiled basketry no particular arrangement of the patterns predominates, but in twining certain arrangements are more frequent on baskets of a particular weave than upon others. Upon plain and upon lattice twined baskets the arrangement is almost wholly horizontal. Upon diagonal-twined it is largely diagonal, with a small per cent. of crossing. A few have patterns covering the entire surface of the basket. The horizontal arrangement only is found upon baskets of the three-strand twined weaves.

In connection with their designs, particularly the horizontal ones, the Pomo seem to have had the rather unusual custom of purposely leaving a break or opening in the pattern, and it is almost, if not quite, impossible to find a basket with its patterns arranged in horizontal bands in which they all run continuously around the entire basket. There is almost always in one of the bands, and usually in all of them, a larger or smaller opening somewhere about it. In some cases these openings are very small

names may be conveniently arranged under the two heads: names of design elements, and names of patterns. The former are simple names of well known natural or artificial objects, geometric figures, and the like; while for a combination of these simple elemental figures to form a complex pattern they give a name which is more of a descriptive sentence or phrase-name than a simple word, since it gives the principal, at least, of the constituent elements and mentions the relation in which they stand one to another. Of course there is a certain variability in the names given to the same design element by different informants, and still more is this true of the names given to the complex patterns. To a large extent, however, what appears a considerable variation in names is found upon investigation to correspond to the differences of dialect, so that within any one dialectic group the naming of elements and patterns is fairly uniform with all informants, though, as would be expected, there are variations among individuals of the same group.

arrowhead, which is however not often applied to these particular figures, *butterfly*, kaca'icai, and *large spots*, dapo'kka. One Central informant gave these designs the name *turtle-neck*, kawīn'a-ūtca, at the same time, however, stating that the design was unfinished. Eastern informants called this design *butterfly*, kaca'icai.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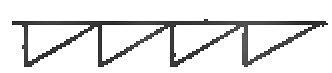
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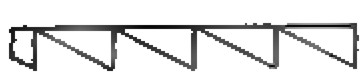
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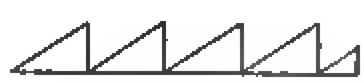
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In figs. 6, 7, 8 and 9 four different arrangements of an ordinary right triangle are shown. By Northern Pomo informants these figures were called *design pointed*, datoī ditī'pka. By in-

in pl. 19, fig. 3, and pl. 17, fig. 6. Patterns of this kind are composed of two spiral designs, one progressing upward toward the left in the ordinary manner, the other progressing upward toward the right, thus causing them to cross each other. All four of the designs shown in these figures find still another use, namely, in what may be termed edging or bordering the large triangles of one of these spiral patterns. Such a bordering, employing the designs shown in figs. 17 and 19, is found in the complex pattern of fig. 55. In addition to these uses, one of the pairs of the four is sometimes employed as the center of a complex spiral pattern. Such a center is shown in fig. 56, in which the designs of figs. 18 and 20 are found. In a separate pattern, such as is shown in fig. 56, these elements are but rarely found. It is occasionally used however as the one filling the central spaces between the large diagonal rows of triangles, as is done by the zigzag in fig. 55. All these designs whether they are used as the primary elements in a complex pattern, or as the secondary elements in such a pattern, are called *arrow-*

respectively, while Central informants always called them *arrow-head-half*, katca′-dalaū. By one or two Northern informants these patterns were also called datō′ī kata, *design empty*. What is in reality the same as these patterns except that the triangular figures cover the entire surface of the basket instead of being arranged in bands is shown in pl. 16, fig. 6. This pattern occurs occasionally and, if unaccompanied by other elements, is called by the same names as the banded triangular patterns above mentioned.

One of the most frequently occurring arrangements of these isosceles right triangles is that shown in fig. 25. It rarely happens that a simple pattern exactly like that of this figure is found, but the great majority of banded or circular patterns are formed upon this as a base. All sorts of other design elements are combined to make the complete elaborate pattern. A noteworthy feature of

25

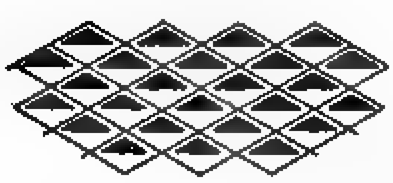
30

31

Northern Pomo this pattern is called datō'ī kata xōltū cakaga-kēya daien, *design empty on-both-sides quail-plumes collected.* A similar descriptive, though shorter, name was given by Eastern informants, who called this pattern xaca'icai hna caga'-xe, *butterfly and (or with) quail-plumes.* By all informants of the Central dialect this pattern was simply called *quail-plume band,* caka'ga-kēya ctot. In fig. 31 a rather unusual combination of triangles is shown. In fact this has thus far been found on but one basket. Information concerning it is lacking from the Northern and Eastern Pomo, but it was called by Central informants katca'-dalaū ctot lala tsīyō'tsīyō tcūwan, *arrowhead-half band in-the-middle zigzag stripe.* In this name curiously enough no mention is made of the smaller inner triangles themselves, only the white zigzag between these small triangles being noted.

tions, to have been part way between the two. Central informants gave the name katca'-dalaū pcē'-meō malada kaden, *arrowhead-half, deer-back near follow-up.* Eastern informants gave the name bū-dilē xaga ko'nawa gadil, *potato-forehead arrowhead on-both-sides passing-along (plural).* By some the design was called merely *butterfly*, xaca'icai.

Fig. 37 represents a pattern which covers the entire surface of a large burden basket. No name was obtained for this pattern among either the Northern or Eastern Pomo but Central informants gave katca'-dalaū malada slema tcūwan, *arrowhead-half near string stripe.*



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The element called string in this case is not, as in the pattern represented in fig. 32, the white line adjacent to the large triangle, but the black line at a little distance.

Figs. 38 and 39 show a pattern which is met with occasionally, not only as in fig. 37, which if resolved into the smallest possible elements will be seen to be the same as 39, but also as

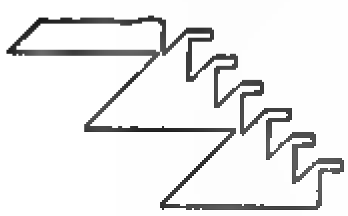
ditī'pka datsai-banem. A Central informant called it taīyō'tīyō balaū-ai ctot, *zigzag half (plural) band.* No interpretation was obtained for it among the Eastern Pomo.

Only one instance has been found of the design shown in fig. 42. Northern informants called this datīpka dilē datapka, *sharp points in-the-middle large-area,* by which it is evidently intended to note the wide white stripe through the middle of what would otherwise be a completed figure consisting of two large superimposed isosceles triangles. By Central informants this pattern was called simply *turtle-neck,* kawī'na-ūtca. By one informant also it was spoken of as simply *arrowhead,* thus in both names no mention is made of the white stripe in the middle. Eastern informants called it xaLū xo'nawa xaga gadil kama, *blank on-both-sides arrowheads passing-along (plural) mark.*

The following twelve figs., 43-54, except 53, have to do with triangles whose apexes are acute angles. Figs. 43 and 44 show a design element which occurs occasionally and which is called by Northern informants *arrowhead-sharp,* katca'-miset, or *arrow-*

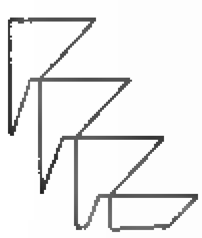
xaga-miset, *arrowhead-sharp,* and kama miset, *mark sharp.*

The design shown in fig. 53 is a combination of the arrowhead with the quail plume and the names given it mention both these elements. It is called by Northern and Central informants *quail-plume arrowhead*, cakaga-kēya katcak and caka'ga-kēya katca respectively, and by Eastern informants *arrowhead and (or with) quail-plume*, xaga' na cag'ax-xe.



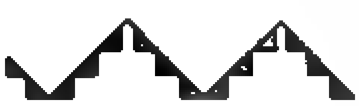
53

The design of fig. 54 has been found in but one case. It was called by a Northern informant *design-sharp,* datō'ī-ditīp, by Central informants *arrowhead-sharp*, katca'-mset, and by Eastern informants simply *arrowhead,* xaga'. This is a very unusual and apparently new pattern, though the diagonal line of large isosceles right triangles with many ordinary sharp pointed projections on the lower side

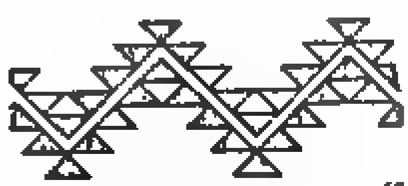


54

Also by other Central informants the components of these patterns were separately named kawī'na-ūtca, *turtle-neck*, the triangular portion of the figure, and msa'kale, *striped-watersnake*, the line in the middle of the figure, in each case. Eastern informants called these figures xaca'icai dilē gaiya kalū'tūduk, *butterfly in-the-middle gaiya striped-watersnake*. This design in its diagonal arrangement is shown in pl. 17, fig. 2.



61



62

63

An unusual arrangement of triangular elements seen in fig. 61 has been found in one case as the central portion of a band of large triangles, such as those in fig. 25. This design was called by some informants simply *arrowhead*, and by others new or *white man's design*.

the most common. The designs shown in figs. 65 and 66 are met with quite frequently, but those of much greater length (figs. 67, 68) are rarely found except as worked into the hoop binding of mortar and burden baskets. The design shown in fig. 69 has been found only once, and that in fig. 70 but once as a border finish design. Also only a single example of a border finish design such as that in fig. 72 has been found

Certain of the above mentioned elements are found not only as finishing designs at the borders of the openings of baskets, but also in bands on the body of the basket itself. These are the designs shown in figures 64, 65, 66, 67, 70, and 72. By the Northern Pomo these designs are usually called dapō'kka, or *large-spots.* The name bicē'-o, *deer-teeth*, is also used. These elements are, however, different from the ordinary deer-tooth design (fig. 74). Central informants usually spoke of these designs as *deer-back*, pcē'-meō, though when very small that of fig. 64 was also

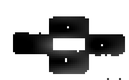
dapō′dapōka, *spotted.* Another name is *deer-teeth,* bicē-o, and one informant also called it *mosquito design,* bita′mta datōĭ. Central informants usually called it *tū′ntūn, ants,* if made up of very small rectangles, and *deer-back,* pcē-meō, if made up of larger rectangles. Eastern informants, however, gave more frequently *deer-teeth,* bicē′-yao, though *tūntūn, ants* was also used. When the rectangles are very small, ant design is almost always the name applied to this design by the people speaking each dialect. Deer-teeth implies a design composed of larger rectangular, usually square, figures. Spots or large spots is more usually applied to a design consisting of comparatively large rectangular figures particularly if they are placed at considerable distances from one another, though these names are not so used extensively in any case.

Small squares or rectangles arranged in patterns consisting of more than two rows as shown in figs. 75 and 76 are quite frequently met with. In the main all informants questioned named

called *deer-back broad-band,* bicē'maō datsai-banem or simply *deer-back,* bicē'-maō. Central informants called it *deer-back band,* pcē'-meō etot, or simply *deer-back,* pcē-meō. The name given it by Eastern informants was *potato-forehead* or *potato-forehead big,* bū'-dilē or bū-dilē tīa.

The design seen in fig. 80 occurs very frequently, in fact, almost as frequently as that of fig. 74. The lengths of these rectangles vary, and the particular rectangles here shown are only typical of the variously proportioned ones which are considerably longer than they are broad. They all bear the same names. This double row of long rectangles arranged horizontally is most frequently called by the Northern Pomo bicē'maō, *deer-back,* though it is also frequently spoken of as *large-spots* dapō'kka. The name *deer-back,* pcē'-meō, was uniformly obtained from Central Pomo informants, while bū'-dilē, *potato-forehead,* was the name usually obtained from Eastern informants. To this name xōtcagan, *running-along-in-pairs,* was also added by one inform-

87



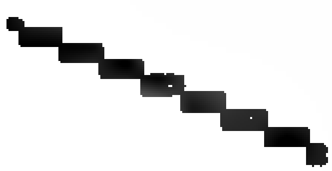
88

Fig. 87 shows a pattern found in only one instance. By Northern informants it was called daki'tka, *scattered-around* by Central informants peē'-meō etot, *deer-back band*, or peē'-meō base't etot, *deer-back ugly (or imperfect) band*. Its Eastern dialect name is bieē'-yaō, *deer-teeth*.

The rectangular design represented in fig. 88 is found occasionally as a separate pattern worked in a colored fiber material on the surface of the basket (pl. 21, fig. 3), or it may be worked in white material in the center of a larger figure made of colored fibers, as, for instance, a large triangular figure. In such a case, the portion of the design appearing in this schematic figure in black is, of course, white. The names given to this design are as

ern informants differentiated the patterns according to the size of the rectangles comprising them, calling the comparatively large rectangles bū'-dilē dzīyō'dzīyō, *potato-forehead zigzag,* and the small ones *t*ū'n*t*ūn dzīyōdzīyō, *ants zigzag.*

One of the more commonly occurring designs composed of rectangles is that shown in fig. 95. This design often occurs alone as a pattern covering the entire surface of a basket The diagonal rows of rectangles are placed with more or less space between them. In such cases, the design is almost always called by the Northern and Central Pomo *deer-back,* bicē'-maō and pcē-meō respectively. By the Eastern Pomo it is called *potato-forehead,* bū'-dilē. In case, however, the component rectangles are comparatively small, the name given to this design by informants of all three divisions was *ants,* bi*t*ū'm*t*ū in the Northern, and *t*ū'*t*tūn in both the Central and Eastern. In addition to its use alone as a pattern proper, it is

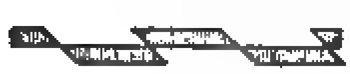


95

(or track) long (plural) by Central informants, and Lal-a-pa, *goose-excrement*, by Eastern informants.

Only one example has been found of a design consisting of a quadruple row of very small rhomboidal figures, such as that in fig. 104. This was called by the Northern Pomo katcak datsa'i-banem, *arrowhead broad-band*. By Central informants it was called kaa'i-kama, *crow-foot (or track)*, and pdū'-cna, *acorn-head (or cup)*. The one name obtained for it in the Eastern dialect was bicē'-maō, *deer-back*.

A design consisting of long rhomboidal figures but so arranged that they slant toward the left instead of toward the right (fig. 105) is occasionally found. This is called by the Northern Pomo sometimes dītī'pka datsaibanem, *pointed broad-band*, though they are also called bicē'-maō, *deer-back*, bicē'-yeō-nat, *deer-breast-?*, and datcē'kka, said to be the name of *a game* in which a long wooden or other skewer is thrust through as many as possible of a string of fish


105

The design consisting of a pair of parallelograms placed so that two of their oblique angled corners touch (fig. 113) has been found on a very few baskets. This was called by Northern Pomo informants datoi datipka, *design sharp-points*, and bicē'-maō datōi, *deer-back design*. By Central informants it was called kaa'i-kama, *crow-foot*, and ka'tīyotīyō, *zigzag*, and by Eastern informants usually dzīyōdzīyō or xatī'yotī'yo, *zigzag*. Another Eastern informant gave the name xama ditīp, *mark sharp*.

A single example was found of a design like that in fig. 114. This was claimed by some informants to be a new fashioned or *white man's design*. No Indian name was given by any of them for it.

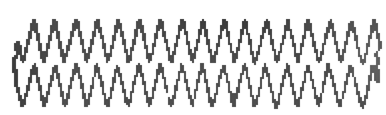
Linear Elements.

The designs shown in the six figures 115 to 120 are what may be termed intermediate forms between angular figures of considerable length and true linear figures. Patterns of this kind

is said to be applied to *approximately parallel lines,* such, for instance, as those which might be made by the dragging of two or three objects through the dust, which would result in lines not entirely straight and parallel but approximately so. Eastern informants also called this figure *sunfish-rib,* tsawa′l-mīsak, and *striped-watersnake,* kalū′tūduk. The one case where the design shown in fig. 133 occurred was on a rather coarsely woven basket of three-rod foundation. In such a basket it is obviously impossible to make a diagonal straight line, the nearest approach to this being a succession of small rectangles, each overlapping those nearest and projecting a little farther to the side than the one below. These small rectangular figures are called deer-back by the Northern and Central Pomo, and potato-forehead by the Eastern Pomo. The names given by some informants to these designs were simply *deer-back,* bicē′-maō among the Northern Pomo and pcē′meō among the Central Pomo, and *potato-forehead,* bū-dilē, among the Eastern Pomo. In addition to these

gave this pattern the names kaca'ıcai kalūltūduk dzīyōdzīyō, *butterfly striped-watersnake zigzag,* and xaga' dilē gaiya kalū'tūruk dzīyōdzīyō, *arrowhead in-the-middle gaiya striped-watersnake zigzag.*

142



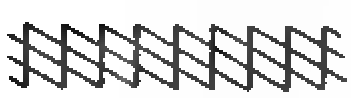
143

Another form of horizontal zigzag, virtually the same as that in fig. 139 except that it is comparatively very broad, is shown in fig. 142. Its names are the same as for the zigzag of fig. 139.

The zigzag represented in fig. 143 differs from the last only in that its angles are very acute. It is, however, specially named by most informants. The Northern Pomo call it tsīyō'tsīyōka katca'k *zigzag arrowheads,* mina-datē'kama katcak, *crossing arrowhead,* and datī'pka, *sharp-points.* Central informants called it tsīyō'tsīyō katca-mset, *zigzag arrowheads-sharp,* and katca'-mset,

was a new kind of *deer-back* design and not the regular aboriginal pattern of that name. Another name given was kase'tka, ***sharp-points.*** One Central informant gave the name pdū'-cna, ***acorn-head (or cup),*** to this design. The design represented in fig. 154 was called by two Northern informants cakō'-bīya, ***grasshopper-elbow;*** by a Central informant kapō'kpōkō kakaiûtcōm, ***spotted kakaiûtcōm,*** and by one Eastern informant bū'-dilē, ***potato-forehead.*** All these designs are comparatively rare, some having so far been found but once.

Fig. 155 shows a design found upon only one basket. Northern Pomo informants spoke of this as dzīyō'dzīyō dilē eiket, *zigzag in-the-middle strip*. Central informants called it tsīyō'-tsīyō sībo kateōm, *zigzag three together;* and some Eastern informants gave the names kalū'tūduk na tsawal-mīsak, *striped-water-snake and (or with) sunfish-rib*, and bū'-dilē dzīyōdzīyō, *potato-forehead zigzag.*



155

and 170 are the typical forms, *deer-back*, bicē'-maō and pē'meō, respectively, while Eastern informants named these same figures *point of* [illegible] and [illegible] *mark*, bū-dilē and tū ntun kama, respectively. The same is true of the design shown in fig. 172. Similarly, one Central informant called the sharp angled zigzag in fig. 179 [illegible] pē-[illegible]ya and one Eastern informant called the design shown in fig. 178 [illegible] -biya. The very sharp angled zigzag represented in fig. 18[illegible] was also called by Northern informants [illegible] [illegible] *arrowhead* [illegible] [illegible] by Central informants [illegible] and by Eastern informants [illegible]

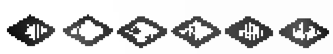
The diagonal zigzag designs [illegible] are found in use by themselves as [illegible] patterns [illegible] perhaps more frequently [illegible] to make [illegible] patterns. [illegible] of these [illegible] zigzag designs [illegible] figs. 174, 18[illegible], 172 and 18[illegible] named [illegible]

of small rectangles, and tsakō'tsakōka, *zigzag*. By the Central Pomo it is called tsīyō'tsīyō, *zigzag;* and by the Eastern Pomo bū'-dilē dzīyō'dzīyō, *potato-forehead zigzag*. This unusual pattern was found upon but one basket.

Another peculiar pattern found upon a single basket is that shown in fig. 188. This was called by informants of all three of the Pomo divisions zigzag, but by Northern and Eastern informants it was also called bicē'-maō, *deer-back*, and by Central informants kaa i-kama, *crow-feet (or tracks)*.

Occasionally a crossing zigzag is found. Such a design is shown in fig. 189. Designs of this kind were called by Northern informants tsīyō tsīyōka kana dayetkanā, *zigzag [illegible] meet (plaited)*; by Central informants ka tiyōtiyō ånalaå, *zigzag crossing;* and by Eastern informants dzīyō dzīyō wīnalkhempke, *zigzag crossing*.

Designs composed of diamond shaped figures with their long axes horizontal, such, for instance, as those in figs. 195, 196 and 197 are quite frequently met with, the last, however, being the least uncommon of the three. The design shown in fig. 195 is called by the Northern Pomo *turtle-back,* kawī'na-tcīdik, and by the Central and Eastern Pomo kawī'na-ūtca and xana'dīhwa-kōī, respectively, both terms signifying *turtle-neck.* One Eastern informant added lik, signifying *band,* to the name turtle-neck. Central informants also called this design *acorn-head (or cup),* pdū'-ena, though this name is more frequently applied to the designs seen in figs. 196 and 197. One Northern informant called this design datī'pka datōī, *sharp-points design,* and one Central informant, who evidently considered this a modern design, gave the name wada'ha tcī. Wada'ha was defined by this informant as the name given to the Spanish game of *cards* and the design was said by her to



195

In figs. 199 and 200 are shown diamond shaped designs which are of very rare occurrence. Both were called new or white man's designs by certain informants of all three dialects, but by other informants Indian names were given, though all seemed to consider them not aboriginal designs. Northern dialect informants called the design of fig. 199 dapō'kka, *large spots,* datı'pka, *sharp points,* and datōī sīsī'sīsi, *design small-figures.* Informants of the Central division gave the names katca'-mtip, *arrowhead-slender,* katca ō'pit-ai, *arrowhead sharp pointed (plural)* katca kapōkpōkō, *arrowhead spotted.* In cases where these figures occur singly or in what has been termed individual arrangement, they were called kapō'kpōkō tatū *spotted single (or one).* Eastern informants also connected this design with the arrowhead, calling it xaga'-mīset, *arrowhead-sharp.* Northern informants called the design shown in fig. 200 datōī tcadō'lai,

dilē winalihempke, *potato-forehead crossing*, was given as one name for this design. One Eastern informant gave as the name of the design of fig. 207 kana dihwa-kōi dilē dūta'p gīwal, *turtle-neck in-the middle wide-mark running-along*. All the designs called turtle neck by Eastern and Central Pomo informants are usually called turtle back by those of the Northern dialect. One informant, however, gave the name kawi na-kū, turtle-neck, to the design shown in fig. 209. Similarly, an Eastern informant called the design of fig. 20[illegible] kana dihwa-kōi, *turtle-[illegible]*.

The rectangular design with points shown in fig. 210 has been [illegible] called [illegible] kawina-kama, and [illegible] It was claimed by most [illegible] a new [illegible] white man's de[illegible] Some informants claim that there [illegible] turtle-[illegible], while one [illegible] design consisting of a [illegible] five projecting points [illegible]

rowhead-half quail-plumes following-on-the-outside, **katca'-dalaū caka'ga-kēya**, *arrowhead-half quail-plumes* or **caka'ga-kēya katca**, *quail-plumes arrowhead.* In cases where the triangle is very sharp-pointed, the name given was katca' mset tōl caka'ga-kēya, *arrowhead-sharp on quail-plumes.* The following names were obtained for this design from Eastern informants: xaga' xō'nawa caka'ga-xe gadıl, *arrowhead on-both-sides quail plumes passing along,* xaga' dile gaiya caga'ga-xe x̀ama, *arrowhead in-the-middle gaiya quail-plume mark,* and xaga'na caga'ga-xe, *arrowhead and (or with) quail-plumes* A band or circle of these arrowheads with quail plumes such as is shown in fig. 30, is occasionally found, particularly on large woven baskets. The name given to such a banded pattern is usually the same as the name of the single triangle with quail plumes, except that sometimes by the Eastern Pomo the name *butterfly* instead of arrowhead is given to the large triangles.

Diagonal rows of large triangles with quail plumes upon the upper side of the row, as shown in fig. 218, are occasionally found.

figs. 18 and 20. Between these may appear almost any of the various forms of zigzag shown in figures 169 to 175, and 178 to 180. Any such combination of these elements is usually called by the Northern Pomo datō'ī kata dilē tsīyō'tsīyō cīden, *design empty in-the-middle zigzag lead.* Some Northern informants gave the same name but omitted the last term. One informant gave the name tsīyōtsīyō data'pka, *zigzag large-area* upon one occasion, and others gave datōī kata dilē cakō'-bīya datōī, *design empty in-the-middle grasshopper-elbow design*, and datōī kata dilē kaa'i-kama daien, *design empty in-the-middle crow-foot (or track) collected,* in cases where the particular kind of zigzag used to fill the middle of the pattern resembled the elemental designs called grasshopper-elbow or crow foot (or track) respectively. Central Pomo informants gave these patterns the names katca lala ka'tīyōtīyo tcūwan, *arrowheads in-the-middle zigzag stripe,* katīyōtīyō mtca'kōlai lēLan, *zigzag mtcakolai in-the-center*, ka'-tīyōtīyō katca, *zigzag arrowhead*, and katīyōtīyo lēLan, *zigzag in-the-center.* Eastern Pomo informants gave xaga' dilē gaiya

the rows of large triangles may be filled either by a single or by a double row of rectangles, usually worked out in the colored fiber material as shown in pl. 18, figs 5, 6, though sometimes in white as in pl. 19, fig. 1. These patterns occur quite frequently and are usually found on coiled baskets, being the only combination of diagonal rows of large triangles and other figures which are met with at all frequently upon coiled ware.

It occasionally happens that there are more than two rows of small rectangular figures occupying the central space between the double row of diagonally arranged triangles. There are instances where two or more rows of such a design element occupy the center of a double row of triangles which itself occupies the center of a double row of still larger triangles. Such a pattern is found in pl. 17, fig. 6, where crossing lines of this elaborate pattern are shown. Among the Northern Pomo such a pattern is called in full datō'i kata dilē katcak dilē kale dapī'dapī diaenga datōī mina-datōkama, *design empty in-the-middle arrowheads in-the-middle white small figures placed-close-together-in-a-row de-*

heads in-the-middle spotted stripe, kapō'kpōkō katca lala tcūwan, *spotted arrowheads in-the-middle stripe,* katca kapō'kpōkō, *arrowheads spotted,* and kapō'kpōkō lēLan, *spotted in-the-center.* In cases where these rhomboidal figures are so arranged that they very much resemble a zigzag, as in pl. 22, fig. 3, they are sometimes called by the Central Pomo ka'tīyōtīyō lala tcūwan, *zigzag in-the-middle,* or ka'tīyōtīyō lēLan, *zigzag in-the-center,* or the name may be shortened to simply tsīyō'tsīyō kama, *zigzag mark.* One Eastern Pomo informant gave the name kapō'kpōkō lala slema tcūwan, *spotted in-the-middle string stripe,* as the name of the pattern of pl. 22, fig. 3, thus in this name taking into account the presence of the narrow white line called string, while omitting to mention the large triangles. Eastern Pomo informants seem to have in most cases considered these diagonal lines of rhomboidal figures as zigzags and they usually gave these patterns such names as xaga' dilē gaiya xa'tī'yōtī'yō gīwal, *arrowheads in-the-middle gaiya zigzag running-along,* xaga' kama

tral dialect informants all gave this pattern the name kaa'i-kama, *crow foot (or track)*, stating that while they, in this particular case named the white zigzags, because they were the most conspicuous, the name applied equally also to the small colored zigzags separating them. Eastern informants gave the names xaga' dilē gaiya dzīyō'dzīyō gadil, *arrowheads -in-the-middle gaiya zigzags passing-along*, xaga' dilē cō bax gadil, *arrowheads -in-the-middle east this passing-along*, xaga dilē' gaiya Lal·a-pa kama, *arrowheads in-the-middle gaiya goose excrement mark,* and dzīyō'dzīyō xōtcagan xō'nawa xaga, *zigzags running-along-in-pairs on-both-sides arrowheads.*

Crossing Patterns.

Lines of pattern so arranged that they cross each other are found now and then upon Pomo baskets. Two such patterns, shown in pl. 19, fig. 3, and pl. 17, fig. 6, have already been discussed. These are very elaborate, particularly the second, which

HORIZONTAL OR BANDED PATTERNS.

Elaborate patterns arranged horizontally or in bands about the surface of a basket, as was mentioned in the general discussion of design arrangement, are met with very frequently, especially upon baskets of the several twined weaves. They are, however, found less frequently upon coiled baskets. Among the twined baskets also these horizontal or banded patterns are much more frequently found upon the large globose storage and cooking baskets and upon the plate-form baskets used for sifting and as general utensils, than they are upon burden baskets where the diagonal arrangement prevails. Occasionally, of course, a burden basket with a horizontally arranged pattern is found, as, for instance, pl. 22, fig. 6, which shows zigzag and rectangular elements of different kinds, each element being itself repeated again and again in the horizontal band about the basket, and none of them being combined with any other element into a complex pattern There are many of these horizontal patterns which,

between the double row of isosceles right triangles such as is shown near the center of the basket in pl. 23, fig. 2, are very common. The name of such a design is in most cases the same as that which is given above but some informants give *grass-hopper-elbow* as the name for this sharp angled zigzag, as also for such patterns as are shown in fig. 147.

PATTERNS COVERING THE ENTIRE SURFACE.

In a large measure, elaborate patterns are confined to spiral and horizontal or banded arrangements, but there are certain cases in which the entire surface of a basket may be covered with a pattern which may be considered neither truly spiral nor banded in its arrangement but which at the same time, if looked at from another point of view, is not only both spiral and banded but crossing as well. Such, for instance, are the patterns shown in figs. 35 and 36, and also in pl. 22, fig. 4, and pl. 16, fig. 6.

between the double row of isosceles right triangles such as is shown near the center of the basket in pl. 23, fig. 2, are very common. The name of such a design is in most cases the same as that which is given above but some informants give *grass-hopper elbow* as the name for this sharp angled zigzag, as also for such patterns as are shown in fig. 147.

PATTERNS COVERING THE ENTIRE SURFACE

In a large measure, [illegible] patterns are confined to spiral and horizontal or banded arrangements, [illegible] there are certain cases in which the entire surface [illegible] covered with a pattern [illegible]

goose-excrement			La'l-a-pa
grasshopper-elbow	cakō'-biya	cakō'-piya	
killdeer eyebrow		kamti'ltali-ūi kūwi	
crow foot (or track)	kaa'i kama	kaa'i kama	
deer elbow		pcē' piya	
sunfish rib		tsawa l msak	tsawa l-misak
mosquito	bita ina		
starfish		stē'ik	
crab claw	ki 'ana		
turtle foot	kaw i es kama	kaw i s kama	kara' i bwa-kama
bat's wing	kata 'a ak a		
bear foot (or track)	bita kama		
deer breast	[illegible]		
deer star [illegible]			[illegible]
elbow	[illegible]	[illegible]	[illegible]
[illegible]			
potato [illegible]			[illegible]
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]		
pine tree	[illegible]		
potato [illegible]			[illegible]

Artificial	*Northern*	*Central*	*Eastern*
arrowhead	katca'k	katca'	kaga'
arrowhead-half		katca'-dalaū	kaga'-daLaū
arrowhead-sharp		katca-mset	kaga'-mīset
arrowhead-slender		katca'-mtil	
inward-arrowhead		tca'l-katca	
outward-arrowhead		ko'l-katca	
arrowhead-sharp pointed		katca'-mtīp	
arrow-split open			xaga'-mīLaū
arrowhead-projecting			xaga'-dīset
string		sle'ma	
game (played with fish vertebrae)	datce'kka		
stretcher			kaitsa'kai xaitsa'k xaitsa'kai
tattoo	ha'ske		
star		kaa'mūl	ūyahō'

Geometric			
zigzag (by which is meant almost any crooked line or object)	tsīyō'tsīyō ka*t*īyō'*t*īyō tsīyō'tsīyōka dzīyōdzīyō tsakō'kakōka tsīkē'ga (?)	tsīyō'tsīyō ka't yō*t*īyō tsīyō'tsīyōka	tsīyō'tsīyō xatīyō'tīyō dziyō'dziyōka dziyōdziyō'
wavy	dīkō'tka		
large spots, spots	dapō'kka		
spotted	dapō'dapōka dapō'kpōkō dapō'dapō dī*t*a'ska		dapō'kpōkō kapō'kpōkō
spot or dot	dī*t*a's		dī*t*a's
small figures	dapī'dapīka sīsī'sīsī dapī'dapī		
little-pieces	bīyō'bīyō bīyō'bīyōka		

Miscellaneous			
initial design	caiyō'ī	caiyō'ī	caiyō'ī
finishing design	baiya'kaū	baiya'kaū	hī'baiyax
empty	kata'		
east-this-mark			cō'-bax-kama
east-place-from-mark		cō-ma-ke'kama	
daylight (?)		kaa'	
door	da'ū, hamaka'm	ham, ha'mda	hwa

available about the basketry of the peoples occupying the territory surrounding that of the Pomo.

Not all these names are used by the people of all three Pomo divisions. There are ten pairs of names which may be considered as equivalents, as follows: deer-back and potato-forehead; turtle-neck and turtle-back; goose-excrement and finishing design; grasshopper-elbow and deer-elbow; zigzag and wavy; large-spots, spots, and spot or dot; small-figures and little-pieces; empty and arrowhead; east-this-mark and east-place-from-mark. The presence of these equivalent names accounts in part for what appears superficially as a radical difference in designs in passing from one of the Pomo divisions to another. Of fully equal importance also are the differences in the qualifying terms used in the different divisions and particularly the variations in the uses of these qualifying terms by different informants. In addition to these names which are equivalent in their application, there are in each of these divisions a number which are not used in either of the other divisions and which have no equivalents, so

really does look like the plume of the valley quail. It is also true that the Indians do not attach any religious significance to these figures They are mainly decorative and seem in all cases to have been named from some real or fancied likeness to objects bearing the same names.

QUALIFYING TERMS.

The figures and plates and their descriptions show that, while the Pomo have only a comparatively small number of elemental design names, the variation in form and proportions of the design elements to which these names are applied is very great. The lack of names of elements is, in a great measure, compensated by the use of qualifying terms, which assists in differentiating designs which are similar, yet quite distinct one from another. These qualifying terms, which are applied chiefly to elemental figures, though some of them are applied also to patterns, may be divided into seven general classes. There are seventeen terms relating to form, five to direction, three to position,

three to size, four to color, five to number, and four to quality. There are also four terms of miscellaneous significance. The following table shows these terms and the particular dialectic divisions in which each is used.

QUALIFYING TERMS USED WITH ELEMENTAL NAMES.

Form	*Northern*	*Central*	*Eastern*
sharp	ditī'p, mīse't	mset	ditī'p, mīse't
slender		mtil	
barbed	dase't		dase't
sharp pointed, sharp point	datī'p	ō'pitai, mtīp	datī'p
sharp points.	datī'pka kase'tka		
projecting			dīse't
pointed	dītī'pka		
wide mark			dūta'p
drawn out	kala'tkaū	kala'tkaū	
large area	data'pan data'pka		data'p
split open			mīLa'ū
forked			bana'
compressed	datsū'ttcīka		
long		kasū'l*t*ak kō'lai	bagi'l
short		ptcō'yai	
circular, circle	tcada'mūl	tcadō'tcadō	
globular	tcadō'lai		
Direction			
inward		tcal	
outward		kol	
upward	ū'yūl		kaiyūla'l
downward	yō'wil		
from (?)		ke (?)	
Position			
above		naū	
lower		yō	
pushed-over	dīka'tka		
Size			
big			tīa
small	bitcū'tcai		kū*t*, kū'dja, xū*t*
swelled or bulged		katsū'ttci.	

Some of these terms are applicable to any and all design elements, while others are used only in connection with one or two. For instance, inward, outward, above, lower, slender, and sharp are used only with arrowhead. Further, many of these terms are used by the people of all three of the Pomo divisions investigated, while others are restricted to perhaps a single division. For instance, the terms inward, outward, above, and lower when used as qualifiers of names of elements, are employed only by the Central Pomo.

These qualifying terms show a predominance of terms relating to form, there being seventeen of them. This is to be explained by the fact that they are applied in most cases to single figures, not to combinations of figures as are the qualifying terms relating to patterns. The small number of terms of direction and of position are noticeable, but are to be expected by virtue of the fact that terms of these two classes belong more generally with patterns or the combinations of two or more figures.

running along in pairs			xōtca'gan
going around			kadabe'mlī
going around and meeting	tcadī'mul		
	tcacite'mūl		
meet	daiye'kamû		kôldaiyaû'hmak
	daiye'tkamū		xōldabē'hmak
collect, collected	daie'n		
connected		cte'ltele	
interlocking	kate'ltaimaû		gaûcaiya'ūhmak
together		katcō'm	
tied together			pase'r
placed close together in a row	daie'nga		
scattered along in a line	dakīkiti'nka		
	dasē'sētenka		
scattered around in a circle	dasī'dasī-mūl		
scattered along	dakīkitin		
scattered around	daki'tka		
	dasī'dasī		
scattered	dasi'dasi	mka'litcai	
	dasī'dasika		
separated		kata'iitcai	
far-apart (?)		taka'oma	

forms of three-strand twining, and two forms of three-strand braiding. While most other California peoples use one type of technique almost exclusively, the Pomo alone to a slight extent make use of wickerwork and employ very extensively both twining and coiling.

The forms also of Pomo baskets show great range. They vary in shape from the very flat plate-form to almost perfect spheres and to cones of various proportions. In addition to these a special elliptical or boat-shaped basket, a form rarely met with elsewhere, is quite frequently made by them.

The variety of pattern arrangements found among the Pomo is very striking. The predominating arrangement, especially upon twined baskets, is horizontal or banded. A considerable proportion of the baskets have their patterns placed diagonally. Comparatively few have patterns arranged so they cross one another or so as to cover the entire surface of the basket in the manner shown in pl. 16, fig. 6. A very few coiled baskets have a vertical or an individual arrangement of their patterns.

Symmetry in the disposition of the patterns is to a large extent

bati'lmahwak, ? (E).

batō', basketry seed-beater (E).

batsī'ya, yellowhammer (N).

batū', basketry seed-beater N, C).

bax, this (E).

bicē', deer (N, E).

bicē' maō, deer-back (N, E).

bicē'-ō, deer-teeth (N).

bicē'-to, deer-stand-in (E).

bicē'-yaō, deer-teeth (E).

bicē'-yee-nat, deer-breast-? (N).

budjī', burden basket [closely woven] (N).

bilī'ya, red-winged blackbird (N).

bis yem, bracken, a black basket material (N).

bita', bear (N).

bita' kama, bear foot [or track] (N).

bita'mta, mosquito (N).

bitcū tcai, small [plural] (N).

bito'i tsoi, burden basket [openwork of peeled rods] (N).

bitsū l, small openwork storage basket (E).

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* The alphabet used in this glossary is described in the present series of publications, VI, 51, 1908 (Ethno Geography of the Pomo Indians).

daki'tka, scattered around (N).
dako', willow hoop (C).
dakō', willow hoop (N, E).
dala', plate-form basket (N, E).
dala'kan, plate-form basket [small] (N).
dala'ū, half (C).
daLa'ū, half (E).
dana', rub (?) (N).
dapī'dapī, small-figures (N).
dapī'dapīka, small-figures (N).
dapō'dapō, spotted (N).
dapō'dapōka, spotted (N).
dapō'kka, large spots, particularly if they are at considerable distances from one another (N).
dapō'kpoka, spotted (N).
dapō'kpōko, spotted (N, C).
dasē'sētenka, scattered along in a line (N).
dase't, barbed; sharp points [two or more points] (N, E).
dase'tka, crossing (N).
dasī'dasi, scattered or scattered around (N).
dasī'dasīka, scattered [either promiscuously or in a row] (N).
dasī'dasī-mūl, scattered around in a circle (N).
data'p, large area; wide mark (E).
data'pan, large area (N).
datapka, large area [of any shape] (N).
datcē'datcenka, ? (N).
datce'kka, the name of a game in which a wooden or other skewer is thrust through as many as possible of a string of fish vertebrae as the string is passing through the air.
da*t*ēkama, lie-on.
da*t*e'n, passing along (plural).
datī'p, sharp point; sharp-pointed (N, E).
datī'pka, sharp points (N).
datō'ī, design (N);
mark of any kind (N).
datsa'i, broad (N).
datsa'i-banem, broad-band. Literally broad placed or put on. It is used in reference to certain basket designs and is equivalent to broad band (N).
datsū'tka, ? (N).
datsū'ttcika, compressed. Strictly the compressing or squeezing of any soft material (N).
daū, space or opening in a pattern, literally door.
dem, cylindrical basket [small] (N).
dīka'tka, pushed over (N).
dikō'tka, wavy (N).
dilē', forehead; in-the-middle (N, E).
dīsa'i, redbud, a red basket material (E).
disai-tō'ts, redbud, a white basket material (E).

haině'dŭ, lattice twining (C).

hai-aĭ'bo, three-rod foundation (C).

ha i tatu, single rod foundation (C).

ha kŏ, conical fish trap (C).

ha'l tsawam, border weave (or braid), literally toward (or at) the mouth braid (C).

ham, space or opening in a pattern, literally end; also near the mouth [used in reference to finishing designs and weaves] (C).

ha mdis, space or opening in a pattern, literally end of it (C).

hawaka m, finishing design (N).

ha ske, tattoo (refers to tattoo marks) (N).

hi bayax, finishing design (F).

hna, and (or with) (F).

hwa, space or opening in a pattern, literally [illegible] (E).

ika [illegible] basket [illegible] openwork of peeled [illegible]

[illegible] basket (N)

[illegible]

[illegible]

kaa [illegible]

kaa [illegible]

kaa [illegible]

kaa [illegible]

ka [illegible]

kī, crab (N).

kibû'k, coiling (E).

kī'cki, twining (E).

kīdī, back, spinal column (E).

kī'-tana, crab claw [or hand] (N).

koho'ī, mountain quail (N, C).

kō'ī, neck (E).

kol, outward. Used only in connection with such triangular elements as those shown in figs. 18 and 19, and said to signify that in making such a figure the work progresses constantly outward, *i.e.*, away from the middle of the pattern, by virtue of the fact that each row of twining is a little longer than the one next below. Cf teal (C).

kō'lai, long [plural] (C).

kōldaiya'uhmak, meet (E).

kō'l-katca, outward-arrowhead (C).

kō''nawa, on-both-sides (E).

kōwal, on the-outside (C).

kōwaldlakade'n, following on the outside (C).

kōwaldlakadē'tan, following on the outside [plural] (C).

kū, neck (N).

kū'dja, small (E).

kūbūm', sedge, a white basket material (N, C, E).

kūt, small (E).
kū'ta, small (E).
Lal, goose (E).
la'la, middle, in-the-middle, among (C).
La'l-a-pa, goose excrement (E).
lē'Lan, center [geometric]; in-the-center (C).
lī'bītsits, bracken, a black basket material (E).
lik, band (E).
maa', acorn (N).
maa-ka'tōla, acorn-head [or cup] (N).
ma'-ce, willow root, a white basket material (C).
mala'da, near (C).
maō', back (N).
mao'dō-kit, bracken, a black basket material (C).
masa'kalak, striped-watersnake (N).
masa'n, whiteman (N, C, E).
ma'-yem, willow root, a white basket material (N).
meō', back (C).
mīdje', mortar basket (N, E).
mīLa'ū, split-open (E).
mille', redbud, a red basket material (N).
mille-to'i, redbud, a white basket material (N).
mina', over, upon (N).
mina'-datēkama, crossing, literally top-lie-on (N).
mina'datēkama, crossing. This term appears to differ from nina'datēkama in that it carries a plural idea, that of crossing endlessly (N).
mīsa'k, rib (E).
mīsa'kala, striped-watersnake (N).
misa'kalak, striped-watersnake (N).
mīse't, sharp (N, E).
mka'litcai, scattered [plural] (N).
msak, rib (C).
msa'kale, striped-watersnake (C).
mest, sharp (C).
mtca'kōlai, ? (C).
mtce, mortar basket (C).
mtil, slender (C).
mtīp, sharp-pointed (C).
mto't, border finish (C).
mūl, in a circle, circular (N).
na, and [or with] (E).
nasū', plate-form basket (C).
nat, ? (N).
naū, above (C).
nē'tak, throw. Probably denotes long or extended (N).
o, teeth. Applied not only to teeth but also to anything with a sharp edge or point (N, C).
ōn'ma, basket (C).
ō'pitai, sharp-pointed (plural).

tcal-katca, inward-arrowhead (C).
tcama'ū, twining; burden basket [openwork of unpeeled rods] (C).
tcī, design, mark, figure (C).
tcīdi'k, back (N).
tcīdī'yemūl, ? (N).
tcīga', lattice-twining (E).
tcil, stuck on, hanging or stuck on the side or bottom (C).
tcī'yaū, ? (C).
tcūwa'k, stripe (C).
tcūwa'n, stripe (C).
te'm-gata, abalone shell (N).
tē'ū, plate-form basket [small] (C, E).
t!i', lattice-twining (N).
ti'a, big (E).
tirī'-bugu, basket of truncated cone form (E).
tīya'l, yellowhammer (E).
tō, stand in (E).
tōl, on (C).
too'-pīka, cylindrical basket (N).
tsai, jay (N, C, E); single-rod foundation (N, C, E).
tsada'r, half-cylinder fish-trap (E).
tsada't, half-cylinder fish-trap (C).
tsaga'tsagaū, oriole (E).
tsakō'tsakọka, zigzag (N).
tsatō'tō, robin (C).
tsawa'l, sunfish (C, E).
tsawa'l-mīsak, sunfish-rib (E).
tsawa'l-msak, sunfish-rib (C).
tsawa'm, border finish, literally braid (N, C).
tsawa'mk, border finish, literally braid (E).
tsīkē'ga, zigzag (?) (N).
tsilī', redwinged blackbird (C).
tsītōk'tok, robin (N).
tsītō'tō, robin (E).
tsīwi'c, balrush, a black basket material (N, C, E).
tsīyō'tsīyō, zigzag (N,C, E).
tsīyō'tsiyōka, zigzag (N, C).
tso'i, small openwork storage basket; burden basket [openwork of peeled or unpeeled rods] (N, E).
tsūba'ha, willow stem (E).
tsūhū'n, ? (N).
tsū'Lī, redwinged blackbird (E).
tū, side (N).
tū'ga, lattice-twining (E).
tūl, side (C).
tū'ntūn, ants (C, E).
ū'ī, eye (C, E).
u'ī-balaū, eye-half (C).

xa*tī*'yō'*tī*'yō, zigzag (E).
xa'xōi, cylindrical fish trap (E).
xe, plume or crest, used in reference to the plume of the quail (E).
xôl, both (N).
xō'kdabe'hmak, meet (E).
xō'l-*tū*, on-both-sides (N).
xō''nawa, on both sides (E).
xôtca'gan, running along in pairs (E).
xū*t*, small (E)
yanī'ya, calico (a term derived from the Spanish).
yaō, teeth (E).
yee, breast (N).
yiī'-cat, feathered basket (E).
yō, lower, down (C).
yō'wil, downward (N).

Figure 7.—Complicated lattice twining employed upon baby baskets.

Figure 8.—Twining upon multiple warp used in border finishing.

Figure 9.—Starting knot in which warp sticks are first joined by twining and then crossed.

diagonal and parallel, or diagonal and crossing. No. 1-366. × ¼.

* All numbers other than those of the series IV B refer to baskets in the Museum of the Department of Anthropology of the University of California; those of the series IV B refer to baskets in a collection made by the author and now the property of the Königliches Museum fur Volkerkunde in Berlin.

rhomboids between. No. 1-3030. × ⅕.

Figure 6.—Diagonal twined cylindrical cooking basket. A crossing arrangement of triangles within triangles which enclose small rhomboids. No. 1-3022. × ⅛.

$\times \frac{1}{5}$.

Figure 6.—Coiled, globose basket. Rows of small rectangles enclosed by large triangles diagonally arranged. The cross shown has been copied from a church. No. 1-3072 $\times \frac{1}{5}$.

Figure 5.—Coiled, elliptical basket with feathers and abalone shell pendants attached. Pattern vertically arranged. No. IVB 7217.

Figure 6.—Coiled, elliptical basket. A zigzag pattern diagonally placed. No. IVB 7224.

Figure 5.—Feather-covered, coiled basket. The opening has a continuous row of shell beads. No. IVB 7208.

Figure 6.—Coiled, elliptical basket decorated with feathers and beads. Crossing triangles extend over the bottom as well as the sides. No. IVB 1719.

No. IVB 7274.

Figure 6. Plain twined. Rectangles and zigzags arranged in horizontal bands. No. IVB 7273.

No. IVB 7305.

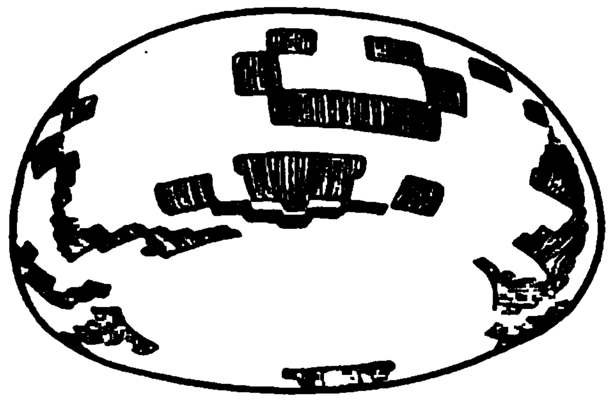
Figure 6.—Plain twined sifting basket with a peg for holding it. No. 1-10607. × ¼.

Figure 4.—Plain twined seed-beater. No. 1-714.

1·4470. $\times$ ⅛.

$\times \frac{1}{15}$.

Figure 6.—A trap provided with a conical mouth to prevent the escape of the fish. No. 1-2587. $\times \frac{1}{15}$.



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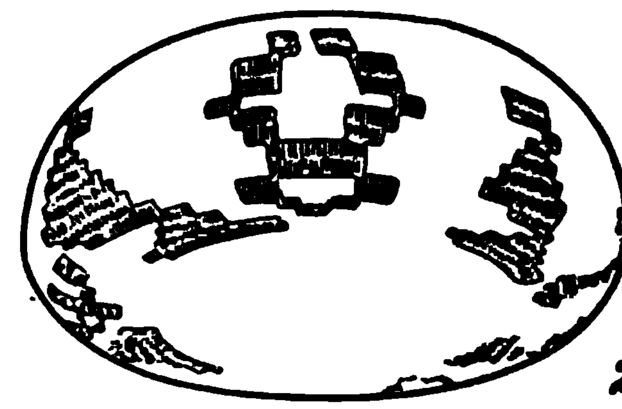

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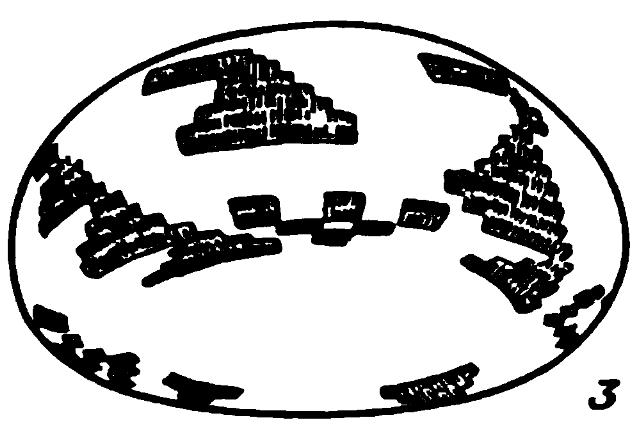

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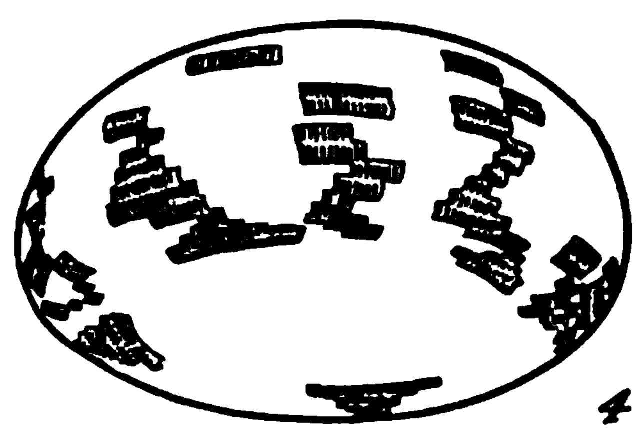

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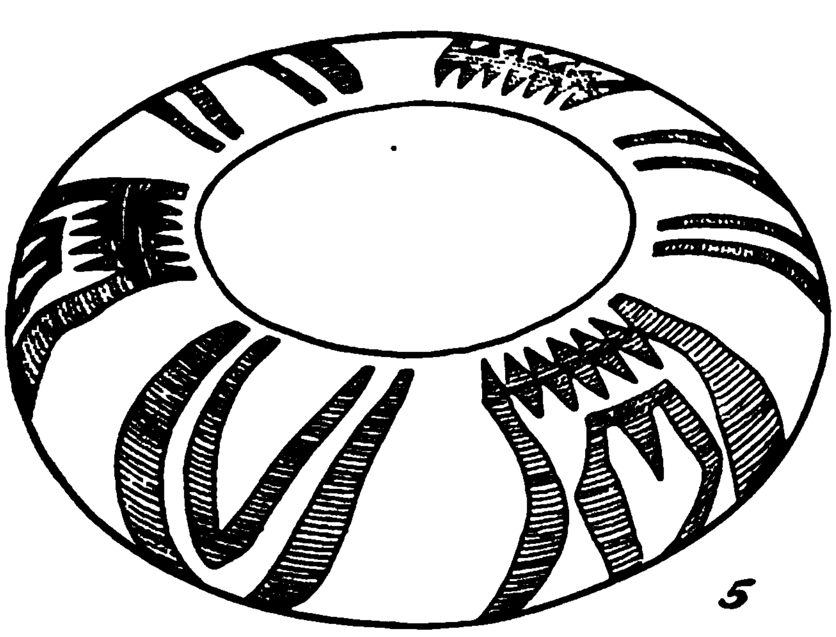

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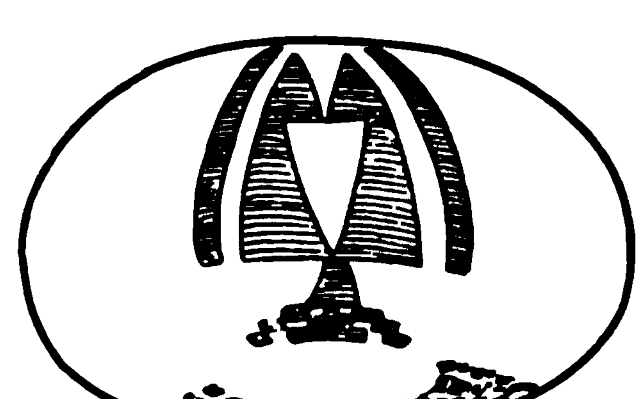

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SHELLMOUNDS OF THE SAN FRANCISCO BAY REGION.

BY
N. C. NELSON.

CONTENTS.

adjacent to the Golden Gate. The ancient remains discovered or re-examined include shell heaps, earth mounds, and a few minor localities that cannot perhaps be termed anything but temporary camp sites. Of the two most numerous forms, the earth mounds are nearly all located by the entering streams, close to the upper reaches of the tide-waters; and their number could be increased indefinitely by searching these stream valleys toward their sources. But as those rather common and widely spread accumulations appear, in many cases, to be of relatively recent origin and possibly representative of distinct cultures, the present paper is restricted to a consideration of the shell heaps.[1] These fairly numerous deposits, with a few exceptions, are situated close to the open bay and may, geographically at least, be regarded as a distinct group.

[1] The earth mounds of Central California have been considered briefly by W. K. Moorehead in his Primitive Implements, p. 258; and by W. H. Holmes, *Smithsonian Report*, 1900, p. 176.

PHYSIOGRAPHICAL AND GEOLOGICAL CONDITIONS.

The waters broadly designated by the term San Francisco Bay are confined to a series of connected depressions in the heart of the Coast Range. The mountain system referred to reaches its narrowest limits in this latitude, where its two or three main ranges have probably always been characterized by a general transverse sag, through which the interior basin of the state connected with the ocean. Since middle Tertiary times, the oscillating movements of the coast, amounting it seems to over 2,000 feet, have concentrated tidal and drainage currents on this pass until at the present time, when the land is relatively high, the enormous drainage of the interior basin reaches the ocean by way of an irregular line of deep gorges, cut through the three or four low barriers that still remain. Descending upon this transverse channel are some six or seven partly united and more or less directly opposable valleys, two from the south and the others

between the towns of Irvington and Niles. The shores of these fresh-water lagoons furnish distinct evidence of permanent settlements in former times, and the fact that the old San Jose Mission is located very near seems in a measure to warrant the opinion that the Spaniards found Indians living in that locality.

In the second place, there are the notable results of the deposition of the suspensible matter brought into the quiet waters of the bay by the streams. Almost the entire bay is fringed with a belt of tide-land, salicornia marsh, which attains a width of from three to five miles at the extremities and is absent only in the constricted central portion, chiefly about the heads of the more prominent peninsulas. Some vegetable matter enters into this marsh composition but it is made up chiefly of a very fine bluish silt. The sources of this silt and the rate of its deposition have probably been much altered in the last fifty years. There

region, tempered as it is by the prevailing ocean winds, may be characterized as insular.

Two seasons, a wet and a dry, are to be sharply distinguished. The rainy period may be said to last from October to April and is on the whole the pleasantest part of the year. The precipitation, which increases rapidly with the latitude, for San Francisco ranges from 23 to 28 inches. Snow is a rare sight and frost seldom touches the low country about the bay. The prevailing winds are from the southwest during the dry season and it is these that bring the fogs. Winds blowing from the opposite direction sometimes bring the heated air from the interior valleys and produce the only hot spells that may be experienced in the bay region. The mean summer temperature for San Francisco is about 60° and the mean winter temperature about 51° Fahr. The mean annual average for thirty-one years is 56° Fahr., while the extreme annual range is only about 60° Fahr.

recent studies among the Indians of Mendocino County, which adjoins the bay country on the northwest.[5] Mr. Chesnut lists and describes the various uses of no less than 212 plants in that region and shows how thoroughly versed primitive peoples may be in the botany of their respective habitats. It is not known just what the difference in geographical distribution may be, but certainly the majority of the economic plants of Mendocino County are to be found also in the vicinity of San Francisco Bay.

The indigenous fauna of California is now much depleted, but there can be no doubt that it once corresponded to the flora in richness. There are some three hundred and fifty species of birds in the state, and of these many of the game birds were until late years very plentiful in the bay region. Of the mammals the state contains fifty three out of the sixty six genera in North America.

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[4] For a full account of the flora of the region consult Jepson, W. L., Flora of Middle Western California, 1901.

[5] Chesnut, V. K., Plants used by the Indians of Mendocino County, California. *The U. S. National Herbarium*, Vol. III, No. 3.

streams. As it is, several more or less obliterated camp and village sites of late and ancient date are definitely known in the region, some of them even on the University Campus in Berkeley; and the publication of news items relating to discoveries here and there of relics and skeletal material is no uncommon occurrence.

The now known list of genuine refuse heaps certainly falls short also of the number that originally existed in the region. Many of the deposits appear to have been either obliterated or destroyed by natural causes. Thus there were discovered, quite by accident, four shell heaps of unknown lateral extent, but from one to three feet deep, that were completely covered by natural deposits, ranging in thickness from one to two and a half feet. Of these four, no. 6 lies at the bottom of Elk Canyon, northwest of Sausalito, and its covering is simply a light sandy alluvium; but nos. 4 and 15, below Mill Valley, lie on hillsides and the covering here is a hard clay or adobe that could have washed

detours into parts otherwise judged unsuitable for mound sites. As a rule trees do not grow directly on the mounds, unless there happens to be a good deal of earth mixed up with the shell and ashes; and the presence of the buckeyes immediately about the deposits is somewhat of a puzzle. It is well known that the Indians of recent times prepared the large, bitter nuts of this tree for food. They are said, moreover, to have used its soft wood for making fire and to have believed in the medicinal virtues of its bark. There can be no doubt, therefore, that at least the latest of the shellmound people also used some of the products of this tree; but it is impossible to say whether they planted the trees about their camps or whether the sites were originally chosen because of the presence of the trees. The latter alternative seems hardly tenable however; and neither may be correct, as the trees in many instances (*i e.*, where they grow on top of the mounds), must have developed from seeds scattered perhaps accidentally at the time of the departure of the inhabitants.

a matter of some consequence. It so happens that the majority of the larger accumulations lie precisely in the places since found suitable for habitation by the modern invaders, and therefore have to give way to the requirements of civilization. Towns are growing up in the principal valleys favored by the shellmound peoples; and in the canyons, as well as on the plains, ranch houses often cluster about, and not infrequently occupy the summits of these ancient dwelling sites. The accumulated refuse has also been found useful in many ways. For example, the composition will sometimes yield splendid crops of potatoes and other vegetables; and this fact, as it has become known, has generally led to reduction and cultivation of the mounds. In addition to this source of destruction, the material is removed to serve a variety of purposes, such as ballast for roads and sidewalks, as garden fertilizer, and even as chicken feed. It is said that the mound material, mixed with rock salt, produces tennis courts that for combined firmness and elasticity are unexcelled. The result is

both those immediately surrounded by marsh and those which are completely insulated by deep and swift currents.

Normally the shell heaps lie quite close to the open waters. The only general variation from this rule occurs on the north and northwest, where some of the deposits are situated four or five miles back from the present shore. But it seems legitimate to assume in explanation of this fact that at least the larger and older of the accumulations in this locality were begun, if not actually abandoned, prior to the building up of the now broad belt of reclaimable marsh, away from which they do not in any case extend very far. A more singular and striking exception occurs on the east, between Rodeo Creek and Carquinez Strait, where two neighboring mounds are situated comparatively far inland and at unusual elevations. Thus no. 254, directly east of the town of Rodeo, is located nearly one and one-fourth miles back from the shore, at an approximate elevation of two hundred

doubted that economy was in some sense a primitive trait, or that these rude savages had intelligence enough to take advantage of a combination of favorable circumstances. At any rate, judging from present conditions, the general scarcity of mounds at the extremities of the region under consideration does not seem inexplicable. The southern arm of San Francisco Bay can not now be regarded as entirely suitable, even if molluscs were abundant, and there is no indication of any very recent change from a better to a worse condition. To be near the main source of animal food would often mean to be several miles distant from the foothills which yielded wood, acorns, berries, etc. And granted even that the alluvial slope was covered with live-oak, which is not at all probable, the water supply close to the shore-line, would still be

[11] Since formulating the above statement the writer visited Halfmoon Bay to locate the mounds thought to exist in that region, and thus to complete the survey of the coast line included in the accompanying map. Several mounds were found here and the largest of these, situated just inside Pillar Point, lies well out in the marsh and certainly goes below sea level.

Pacific Coast from the Columbia River to Southern California, as well as on the Atlantic shores from Virginia to Labrador. There are besides, for the world at large, some more or less complete records of investigations in such widely separated localities as the West Indies,[16] Brazil,[17] Chili,[18] Peru,[19] Japan,[20] Australia,[21] Italy,

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[12] Smith. Rep., 1860; also Affaldsdynger fra Stenalderen in Danmark by Sophus Muller, K. J. V. Steenstrup and others, Kjobenhavn, 1900.

[13] Moore, Clarence B., Certain Shellheaps on the St. John's River, *Amer. Naturalist*, 1894. Also this author's publications by the Academy of Natural Science of Philadelphia.

[14] Dall, W. H., Tribes of Extreme Northwest. [illegible] *N. Amer. Ethnol.*, Vol. I.

[15] Smith, H. I., Mem. [illegible] Mus. Nat. *Hist.*, [illegible] I, part 6, Vol. II, parts 4 and 6, of the publications of the Jesup Expedition.

[16] Fewkes, J. W. The Aborigines of Puerto Rico. [illegible] *Rep. Bur. Amer. Ethn.*, 25, p. [illegible]

[17] Reclus, J. J. E., The Earth and Its Inhabitants, Vol. II, p. [illegible]

[18] Evans, O. H., Notes on Stone Age in Chili. [illegible] 1906.

[19] Uhle, Max, Los [illegible] Lima, 1906.

[20] Morse, E. S., Shell mounds of Omori [illegible] 1879.

[21] Roth, W. E. [illegible] No. 3, 1901, p. 7.

no effigy mounds among them, as in Brazil;[23] nor are there any strong suggestions of defensive or ceremonial purposes about them, as in Australia.[24] At the same time these accumulations are not quite in the same class with the enormous shell heaps which, whether entirely artificial or not, are found in several places on the Atlantic shores of both North[25] and South America where they often cover many acres to a depth of as much as twenty feet. From previous description it will be recognized that the San Francisco Bay shell heaps are comparatively small

[23] See Reclus, The Earth and the Inhabitants, p. 108.

[24] Roth points out that the large and remarkably steep-sided shell heaps at the junction of the Hey and Embley rivers in Australia could readily be defended against attacking enemies and suggests further that the shell-and-ash composition probably afforded protection against fleas and other insects. *North Queensland Ethnography Bull.*, 3, p. 7.

Mound no. 256, east of Rodeo, is situated on a hillside directly above the entrance to a cave. This cavern, said to be forty feet long and of more than man's height, may well have served for protection against enemies but its chief importance was probably as a source of water supply.

[25] *e.g.*, Holmes, W. H., *Am. Anthropologist*, n. s., Vol. IX, p. 113.

practically homogeneous mass in which nearly all the shells are crushed. At first, such a condition seems perfectly natural. But the rule does not hold in all cases. That the disintegration at the surface is the normal result of weathering and vegetal processes need not be doubted; but the finely broken shells of the lower half or two-thirds of the pile do not represent a clear case of disintegration. It is true that the lower levels of the mounds in question are made up largely of mussel shells, the bits of which are somewhat softened and fragile, though they still retain their lustre, and it might be argued that the mere weight had crushed the mass and reduced it to its present consistency. However, there is a small admixture of clam and oyster shells, nearly always crushed to the same fineness as the mussels, but sometimes scattered about entirely unbroken. The clam and oyster fragments are still quite as firm as the shells of the present day; and if weight or disintegrating processes reduced some, why not all? Again, if the weight could crush the mussel shells in some of the

Oyster, *Ostrea lurida*.
Mussels, *Mytilus edulis* and *M. californianus*
Modiola, sp.
Soft-shelled clams, *Macoma nasuta* (and *M. edulis?*).
Mya arenaria.
Hard shelled clams, *Tapes staminea* and *T. tenerrima*
Cockle, *Cardium corbis*.
Abalone, *Haliotis rufescens*
Purpura crispata and *P. canaliculata*
Cerithidea californica
Olivella biplicata.
Acmea patina
Standella, sp.
Land snails, *Helix*, two species.

VERTEBRATE FAUNA.

While the indicated change in the preponderating shell species is of no particular cultural significance, it is otherwise with the remains of the vertebrates represented. There are no sharp changes from invertebrates to vertebrates and from fishes to

inhabitants, may have originated activities along other fundamental lines; though the clear proof of such seems wanting. For instance, it is tolerably certain that skin-dressing and basketry were practiced in late times, but with our present knowledge it would be unsafe to say when these arts began or even that they did not arrive with the first appearance of the mound people. More evident seems the relatively recent development of certain luxurious habits and tastes such as are implied by the presence of pipes, musical devices and decorative objects. Finally, it may be well to add that there appears to be no form of artifact found at the bottom of the accumulations that does not also occur near the top.

The culture as observed, were one to describe it in terms of the present system of archaeological classification, is neolithic. Some roughly chipped flint and chert flakes were indeed found in the lower horizons of one of the shell heaps, but these pieces may

Referring to the positive side, the [illegible] of the San Francisco Bay shell heaps conforms, at least in its [illegible] features, to that of the late Indians of the surrounding [illegible] generally designated as Middle California [illegible] of the shellmound peoples on the Atlantic [illegible] have shaded into the civilization of the [illegible] historic times. [illegible] negative [illegible] evidence of work in clay [illegible] the mound groups [illegible] the San Francisco Bay [illegible] California [illegible] worked [illegible] shell heaps [illegible] are also found [illegible] appear, therefore, that [illegible] cultural evi-

[illegible] homes [illegible] places [illegible]

[illegible] brought [illegible]

it may never have served as permanent residence, it becomes reasonable still to believe that the mound is anywhere from three to four thousand years old.[28]

THE IMPLIED POPULATION.

In view of the astonishment commonly expressed with reference to the great number of shell heaps in the San Francisco Bay group, it may not be out of place in closing to remark briefly on the probable aboriginal population. There are insuperable difficulties in the way of arriving at even an approximately satisfactory answer to the question, and this would still be the case were the original number of mounds present. In the first place, it may safely be assumed that the shell heaps were not all begun at the same time; and, in the second place, it is practically certain

[28] Dall estimates 3,000 years as necessary for the accumulation of some of the Aleutian Island mounds, and the age of some of the kitchen middens in Denmark has been placed at 3,500 years.

but nearly all of these peculiar eminences appear to have been occupied by the aborigines. View looking south

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THE ELLIS LANDING SHELLMOUND.

BY

N. C. NELSON.

CONTENTS.

INTRODUCTION.

Of more than four hundred artificial shell deposits known in the San Francisco Bay region, perhaps none is of more general scientific interest than the large accumulation at Ellis Landing, near Richmond. This mound, besides being a conspicuous archaeological feature, furnishes incontestable evidence of having survived a considerable subsidence of the bay country which occurred subsequent to the arrival of primitive man, and has for these reasons been singled out for special investigation by the Department of Anthropology of the University of California.

The opportunity for systematic work on an extensive scale did not present itself until the summer of 1906. Previous to that time, during a period extending over several years, the University Museum had acquired by gift and by purchase a fairly representative collection of artifacts, numbering about two hundred and fifty specimens. While generally representative of the given culture, the value of this collection lay chiefly in the

TOPOGRAPHY OF THE REGION.

To the casual observer who visits the mound-site, the region appears as a broad valley, cut short at both ends by the bay waters, but in width stretching from the Berkeley Hills on the east to a range of hills about three and a half miles to the west. The western range, known as the Potrero San Pablo, is a narrow six-mile stretch of hills rising suddenly about half a mile west of Ellis Landing and extending in a northwest-southeasterly direction, parallel to the general trend of the Mt. Hamilton Range on the east and the Tiburon Peninsula on the west. Brooks Island is geologically a part of this range, and was probably connected with it until within comparatively recent times.

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[1] Cf. the San Francisco Quadrangle (California) of the Topographic Map of the United States, by the United States Geological Survey, on which the mound-site may be located at the intersection of 37° 55′ N. latitude and 122° 21′ 30″ W. longitude. Twelfth Street of the city of Richmond, if extended across the marsh, would also intersect the mound.

bility close by the Ellis Landing mound on its way to San Francisco Bay.

GEOLOGIC FEATURES OF THE REGION.

Depth of the Alluvial Formation.—From the records of wells driven on the flats east of Richmond it is seen that the alluvium contains a number of irregularly radiating streaks of water-bearing gravels ranging in different places from three feet to several hundred feet below the surface. Of late years, it appears that many of the shallow wells on the flat have gone dry, owing probably to the fact that both the Standard Oil Company and the People's Water Company have driven a large number of wells in various places on the tract.

Three well-borers testify independently to these general facts; and one of them, Mr. Boorman, who has driven wells in the neighborhood since the late fifties, says that for an extra good flow of water he has been in the habit of boring from seventy to

the creeks flooded the whole region about the old Spanish town, and on one or two occasions the ranchers were forced to seek refuge on a shellmound situated on the bank of the upper stream. Other hearsay evidence, but from seemingly good sources, is to the effect that there was not long ago an open channel or tidal race along the east base of the Potrero Hills, connecting San Pablo Bay with San Francisco Bay proper. It is stated that the channel was navigable for scows as late as fifteen years ago, and it is vouched for definitely that in 1862 a steamer "large enough to go to China" went through. However, the silting up of this channel was no doubt hastened by artificial means.

SITUATION OF THE MOUND WITH RESPECT TO RECENT GEOLOGIC CHANGES.

The position of the mound itself may once more be given as on the submerged southwestern perimeter of the San Pablo-Wild-

entire mound.

Another unexplained feature is the thin streak of shell and fine pebbles which extends in a horizontal plane as much as three hundred feet away from the mound in all directions. It would seem as if, when the plane of the silt deposition was at the level of the apex of the wedge, there had been some unusual disturbance such as was never repeated.

As to the foundation itself, where examined, it is generally composed of medium coarse yellow gravel. In some places about a foot of dark, sticky material intervenes between the gravel and the mound deposit, these patches being evidently soil or material made up of finer drift which had been covered with vegetation. It therefore appears that the mound was begun on dry land that had been above sea-level for a considerable period of time. In many places, however, the shell appears to rest directly on the gravel, and this, near the perimeter on the sea side, becomes blue or bluish green in color and is mixed with a good deal of sand.[6]

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[6] For a broader treatment of the physiography of the San Francisco Bay region as a whole and its relation to shellmounds and shellmound culture, see the author's paper entitled Shellmounds of the San Francisco Bay Region, *Univ. Calif. Publ. Am. Arch. Ethn.*, Vol. 7, pp. 312-318.

of which are now scattered among individual curio-collectors.

The preceding description, it should be noted, refers to the mound as it appeared in 1906. The mound as it was before subsidence may be determined approximately from the data given on plates 48 and 49.

In order to obtain the mound's outline with reasonable accuracy, a straight east-and-west line was laid off on the beach, and a point in it least liable to disturbance was chosen as zero. This zero, located at the intersection with the A-B section, was used as a reference point throughout the work of 1907, both for locating specimens and for plotting the mound. The latter was accomplished by staking out, with the beach line as a base, two rectangles about the respective sea and land portions of the mound, the perimeter of which was then determined by measurements taken at every twenty-five-foot interval. On the sea portion of the mound this work had to be done during the intervals of low tide, and here permanent stakes were set to mark the surface

illustrated on plate 50, figure 1.

Mound Removal of 1907.—The removal of a large part of the mound for grading purposes in 1907 afforded a most excellent opportunity for further study at comparatively slight expense. As shown on plate 48, the portion removed took in a rectangular section on the seaward side, measuring about 60 by 160 feet. With three to four teams of horses moving about within these limits, the archaeological work was necessarily done at some disadvantage. All possible care was taken, but expeditious work was sometimes the first essential. The only practical way to obtain location figures was by a series of stakes set at five-foot intervals along two adjacent sides of the excavation. From these the horizontal position with reference to the zero point on the base line could be obtained very easily and quickly. The depth in most cases had also to be estimated from the same stakes. In spite of these difficulties, no unusual discrepancies were apparent when the general nature of the finds was compared with the more

there are no well-defined strata of raw and calcined material such as marked the upper part of the Emeryville mound.[9] The line which marks the division between this loose superficial material and the substructure is very definite and, in the main, regular. Below it the material is of an almost uniformly fine and compact nature and likewise of a nearly homogeneous composition.

The [illegible] Emeryville [illegible] well defined [illegible] bedding [illegible] at some few points [illegible] shaft, where they are [illegible]

[illegible]

[illegible]

portion of this accumulation is composed almost exclusively of mussel shells, and it is only in the upper eight feet that the clam shells become at all plentiful. This fact seems to admit of one or two possible interpretations: either the local physiography of early shellmound times was very different from that of the present day or else the mound people possessed boats of some sort.[10]

[10] Don Jose de Cañizares, the able Spanish pilot who conducted the first thorough survey of San Francisco Bay in the year 1775, in the report to his superior, Lieutenant Ayala, describes some interesting native crafts of that day. The pilot makes note of two Indian rancherias, one situated near the head of the San Francisco Peninsula and another near the west end of Carquinez Strait. With the latter community, which he says consisted of about four hundred souls, he had repeated dealings, visiting them in all four times, and he writes: "This Indian village has some scows or canoes, made of tule, so well constructed and woven that they caused me great admiration. Four men get in them to go fishing, pushing with two-ended oars with such speed that I found they went faster than the launch." In the log of the *San Carlos*, which was anchored near Angel Island during the absence of Cañizares, Commander Ayala has himself entered the statement that fifteen Indians came on a raft and were taken on board. Translations by E. J Molera of the documents in question, together with a photographic reproduction of the first map of San Fran-

tions of barnacles, still firmly attached. Apparently these specimens were originally removed from a salt-water beach such as is not now found in the immediate vicinity.

HUMAN REMAINS.

The Ellis mound was used from the beginning for burial purposes. This fact is not in itself remarkable, even were it not known to have been a world-wide practice to bury in the refuse-heaps, because interment in any other place would have been comparatively difficult under primitive conditions. There are no sand beaches on the bay shore, and the soils of the region are tough, and in fact quite impenetrable during the dry season to any but the best modern implements. These facts should, of course, not be taken as the precise and only reasons for shell-mound interments, either here or in any other part of the world. It seems probable, however, that many such customs, even those having the strictest religious motives behind them, originated somehow in mere external necessity.

were uncovered. In all possible cases, however, the essential facts regarding the position and arrangement of the bones were noted and [illegible] show what [illegible]

[illegible] of these [illegible] The prevailing [illegible] the body [illegible] heels [illegible] resting on [illegible] 1907 [illegible] both [illegible] end of [illegible] earth, generally [illegible] it will [illegible] than the [illegible]

for striking. Some of them have either one or both of the mortar and pestle characteristics (pl. 42, fig. 3). That is to say, some have the shape of a short pestle with small depressions in one, two, or more of its sides; and others are cylindrical or discoidal, the end depressions being sometimes natural and adapted for holding the stone in striking with its edge, or the depression may be clearly artificial. A stone similar to the discoidal form is said to be used by the present-day Indians for cracking nuts and acorns. The various forms here recognized must have had several different uses, however They exhibit no particular workmanship.

Rubbing or Whetstones.—It is difficult to apply any term other than "rubbing stone" to certain varying forms made of sandstone, all of which present one or more flat surfaces that have resulted from use. There are several of this kind in the collection, and one or two of them show marks of having been brought into shape by some pecking process (pl. 42, fig. 4).

[14] Moorehead, W K., Prehistoric Implements (1900), p. 288, fig. 2.

Charmstones.—The great variety of forms generally designated charmstones were well represented at the Ellis mound. More than seventy were obtained, the specimens being found only in the upper levels of the deposit. In shape they range from nearly spherical to long, slender forms with more or less pointed ends. Plate 43 illustrates the most characteristic forms. That most of them were intended for suspension is indicated in some cases, as in figures 3 and 6, by asphalt still remaining on one end, this substance sometimes showing actual impressions of the fiber used. In other cases, illustrated by figures 5 and 7, there is a knob or a perforation at one end. In a so-called phallic form, named and partially illustrated by Moorehead,[18] both ends are

[17] A similarly grooved specimen lacking the perforations was found in the mound at Emeryville (see Uhle, *op. cit.*, fig 8, pl. 12); and others of like form have been obtained at Santa Barbara and the adjacent islands. For illustrations of the latter finds, see F. W Putnam in the Wheeler Rep. on U. S. Geogr. Surveys west of the 100th Meridian (1879), Vol. 7, pp. 211 and 212, figs. 89, 90, and 91.

[18] *Op. cit.*, p. 281, fig 421.

at opposite ends and resemble in general outline an ordinary cork. The squarely cut ends vary, in that some are true planes while others are slightly concave. Their use can scarcely be surmised.[21] It may be that they are simply sections of broken charmstones ground smooth at the ends.

Figure 9 is almost cylindrical with slightly rounded edges. It measures ⅞ of an inch in length and has a diameter of 1¾ inches.

Figure 10 is not absolutely symmetrical but it is about 15/16 of an inch long, with a diameter measuring on the average ⅞ and 15/16 of an inch respectively.

Pipes.—The most remarkable of the new forms found in the mound were probably the two or three steatite pipes shown on plate 45. Figure 3 was found with the group burial in the trench, and is a small cup-shaped specimen with a perforation

[21] Two different suggestions have lately been made to the writer regarding the purpose of these specimens. One is that they were used as labrets, and the other that they were used as rests or anvils on which to crack nuts and acorns.

lateral half of a metapoidal (figs. 9 and 10). Sometimes a slightly different form is made by splitting the bone a second time, giving a small triangular cross-section (fig. 4). Occasionally the distal end of the tibia was used, but this bone does not split so regularly. The anconeal process of the ulna (fig. 5) was also quite frequently used, as it has been by shellmound people in many parts of the world. Many of the awls still retain a beautiful polish.

One noticeable peculiarity about many of the awls from the Ellis mound is a longitudinal groove worn on either or both of the flat sides. These grooves, partly shown by figures 5 and 10, are sometimes worked clear through the handle, thus producing

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[25] Harlan I. Smith, Shellheaps of the Lower Frazer River; *Mem. Am. Mus. Nat. Hist.* (1903), vol. 4, p. 181. By the same author, in the same series, see also vol. 2, Archaeology of the Thompson River Region (1900), p. 429.

[26] P. E. Goddard, Life and Culture of the Hupa; *Univ. Calif. Publ. Am. Arch. Ethn.* (1903), vol. 1, pp. 36-37.

when for some time she may not touch her head directly with her fingers.

Barbed Bone.—A second form not noticed before, at least in the shellmounds of the bay region, is illustrated by figure 2, plate 46. It is simply a piece of strong, split limb bone, pointed at one end and provided with a barb on one side. Excepting for a longitudinal curve it might readily be taken for a harpoon point of the common North Pacific coast type.

Shuttle-shaped Implement—Perhaps the most interesting of the new forms of bone work found in the Ellis mound is illustrated by the accompanying text figure.[35] The object is difficult

[33] *Op. cit.*, Vol. IV, p. 177.

[34] Nelson, E. W., The Eskimo about Behring Strait, *18th Ann. Rep. Bur. Ethnol.* (1896-7), p. 57.

[35] The Museum specimen, no. 1 11186, is much decayed and in a very imperfect condition. The illustration is made from a slightly different specimen recently found in one of the Alameda shellmounds, and by courtesy of the custodian, Mrs. M. H. Krautle, Librarian of the Alameda Public Library.

sible fiber work occurred very near the surface.

Utensils Adapted from Shells.

Aside from their use in making ornaments, sea-shells seem to have been little used by the occupants of the Ellis mound. Strictly speaking, there is no evidence that these people ever made use of shells for anything but ornaments; at the same time, the repeated occurrence, with human remains, of large specimens of abalone shells points to their probable adaptation as receptacles. They might well serve the purpose of dishes although the line of apertures extending across the deeper part of the shell appears not to have been plugged up with asphaltum or any other non-perishable substance, as was the practice in Southern California. Aside from these grave finds of abalones, a number of large, heavy *Tapes* shells were obtained, which it would seem might have been used for various household purposes.

singular specimen was obtained from Mr. Ellis, who cannot vouch for its exact occurrence.

In addition to these illustrated specimens there was obtained a single example (no. 1-13024) of a small conical shell, *Acmea patina*, which may have had the apex artificially ground away. The perforation at any rate made it ready for suspension; and shells of this sort are said to have been used by late Indians of the California Coast as a "drop" for ear-rings.

Stone Ornaments.—From Mr. Ellis were also obtained quite a number of small or delicately worked stone implements that could hardly have had any other purposes than to serve as ornaments. All the different forms of this lot are illustrated on plates 45 and 47. Among them is a fragment of a circular disk or ring, a piece of perforated mica, and a whole series of pendants The forms of these pendants, it will be observed, are circular, triangular, and oblong. Their lengths vary from three-fourths of an inch to two and one-half inches, and their weights

SUMMARY AND CONCLUSIONS.

The Ellis Landing shellmound is situated on the northeast shore of San Francisco Bay, upon the submerged portion of a large fan or delta of geologically recent origin. It rests upon solid gravel, but is more than half buried in fine silt, which attains a depth about it ranging from eleven to sixteen feet. Above the surface of this silt, now covered with vegetation, the high tides rise at times more than two feet; so that it is fair to assume that the region has sunk at least eighteen feet since the ancient inhabitants began to accumulate the refuse deposit. The precise nature of the geological movement recorded by the mound is difficult of determination; but it seems to have comprised

[37] For similar pieces from other parts of California see Moorehead, *op. cit.*, p. 272, fig. 411.

later times, and the progress towards perfection of manufacture is generally marked; but aside from these normal changes there are no important breaks in the culture represented. This means that if more than one people have lived on the mound, whether these were friendly migrants or disputing enemies, they were all essentially of the same type of culture, and the last occupants of the shellmound at Ellis Landing were probably Indians similar to those that have lived in Middle California within historic times.

Height (basion-bregma)	142	
Gnathic—x (basion-alveon)	91	approximate
Gnathic—y (basion-nasion)	100	
Diameter, frontal minimum	100	
Diameter, bizygom. maximum	147	
Breadth of nose, maximum	25	
Height of nose	52	

Cephalic Index, 73.34

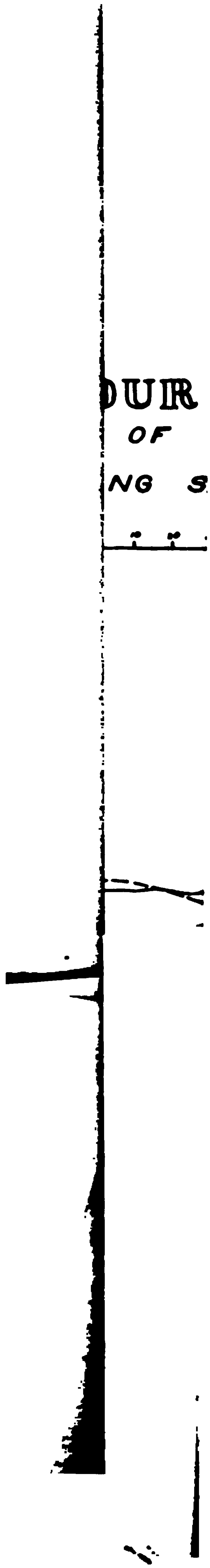
Gnathic Index $\left(\frac{x \times 100}{y}\right)$, 91 approximate

Nasal Index, 48.07

10 ornamented with beads (text, pp. 394, 397).

All figures about two-thirds natural size.

All figures × ½.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Page 185, line 9	**For ''kū wi'' read ''kūwi.''**
Page 187, ls. 6, 24.	**Insert comma between ''arrowhead-projecting'' and ''xagá datip.''**
Page 188, line 8.	**For ''dalu'' read ''dalau.''**
Page 204, line 14	**Omit comma after ''maō''**
Page 205, line 10	**For ''oṓ'' read ''ṓ.''**
Page 206, line 7	**For ''(or with)'' read ''and (or with).''**
Page 207, line 22	**For ''wina'' read ''mina.''**
Page 209, line 36.	**For ''xaga datap'' read ''xaga'-datap.''**
Page 210, line 32	**For ''peē' meo'' read ''peē'-meo.''**
Page 218, line 10.	**For ''thrown'' read ''shown.''**
Page 218, line 19.	**For ''dasē sē tenka'' read ''dasē sē tenka.''**
Page 218, line 20.	**For ''scattered along in a line'' read ''scattered along-in a line.''**
Page 232, line 13	**For ''daie n'na'' read ''daie'nga.''**
Page 248, line 8	**For ''[illegible] blank'' read ''*etot* blank.''**
Page 27[illegible], line 1	**For ''peē' meō, *etot*'' read ''peē'-meō *etot*.''**
Page 2[illegible]3, line 8	**For ''arrow split'' read ''arrowhead-split.''**
Page 2[illegible]1, line 9	**For ''hata'' read ''hua.''**
Page 27[illegible]	**''Cabil, long (E)'' is omitted from glossary**

Errata.

Page 270. "Gaūk, man(E)" is omitted from the glossary.

Page 280, line 5. Insert "and" after "ones."

Page 280, line 16. Omit "shell."

Page 282, line 4. For "Horizontally" read "Diagonally."

Page 282, line 9. For "the middle band" read "all three bands."

Page 284, line 8. For "having a row of rectangles" read "and having a zigzag."

Page 286, line 3. For "rectangles" read "zigzag."

Page 286, line 16. For "vertically arranged" read "arranged in zigzag."

Page 292, line 10. For "border" read "bordered."

Page 292, line 13. For ", and rhomboids diagonally arranged" read "bordered by smaller triangles and with three narrow lines between."

Page 294, line 3. After "by" insert "the dau which is filled with."

Page 294, line 5. Omit "winnowing."

Page 294, line 8. For "an interruption" read "the dau."

Page 294, line 13. For "an interruption" read "daus."

Opposite page 296. Pl. 24, the wrong object is illustrated in fig. 4. A seed-beater in plain twining on radiating warp should have been shown.

Page 298, line 3. For "storage" read "tobacco."

Page 298, line 5. Before "Lattice-twined" insert "Openwork."

Page 298, line 6. For "on a multiple foundation" read "plate-form basket."

Page 304, line 4. For "designs" read "elements."

Page 306, line 3. After "designs" insert "which are newly invented under American influence."

Page 306, line 5. For "An isolated design" read "One side of coiled basket showing one of its three equally spaced designs of unusual form."

Page 308, line 2. After "twined" insert "bundle warp."

Page 308, line 3. To read: "Figure 2.—Braided and twined warp border. No. 1-3040."

Page 308, lines 4, 5. To read: "Figure 3.—Simple turned-down warp border."

Page 339, line 34. For "*memphitis*" read "*mephitis.*"

Opposite page 416 and following, the objects illustrated are catalogued under the following numbers in the Museum of the Department of Anthropology of the University of California: Pl. 42, fig. 1, 1-13296, fig. 2, 1-13205, fig. 3, 1-13207, fig. 4, 1-11488. Pl. 43, figs. 1-11 respectively 1-13166, 1-11539, 1-11537, 1-10662, 1-13066, 1-11498, 1-13201, 1-11544, 1-11546, 1-13022, 1-13279. Pl. 44, figs. 1-8 respectively 1-13910, 1-13909, 1-13924, 1-13912, 1-13191, 1-13156, 1-13155, 1-11201, figs. 11-13 respectively 1-11552, 1-11506, 1-11522, fig. 15, 1-11189. Pl. 45, figs. 1-9 respectively 1-13164, 1-13163, 1-11188, 1-11502, 1-11144a, 1-11184, 1-11145, 1-11187, 1-13052, figs. 10-11, 1-13218. Pl. 46, figs. 1-10 respectively 1-11172, 1-11259, 1-9663, 1-13030, 1-11177, 1-13091, 1-11523, 1-13013, 1-13158, 1-13062. Pl. 47, figs. 1-20 respectively 1-13192, 1-10687, 1-9123, 1-10661, 1-9122, 1-10657, 1-10642, 1-10656, 1-9116, 1-10652, 1-9117, 1-10653, 1-10658, 1-10655, 1-10643, 1-9118, 1-10644, 1-10651, 1-9119, 1-10648.